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JOURNAL OF GENETIC PSYCHOLOGY

Child Behavior, Animal Behavior, and Comparative Psychology

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VOLUME 89

1956

Copyright, 1956, by The Journal Press
Published Quarterly by The Journal Press
Provincetown, Massachusetts, U. S. A.

AUTHOR INDEX

Angelino, Henry 263
Ausubel, D. P. 85, 95
Baron, A. 61
Beach, Frank A. 165
Brown, W. Lynn 213
Burke, Maurice O. 71
Calvin, Allen D. 11
Clifford, L. Thomas 11
Conovitz, Myron W. 165
Crandell, Vaughn J. 239
DeWit, F. 85
Dollins, Joseph 263
Ellen, Paul 35
Fauls, Lydia Boyce 105
Finocchio, D. V. 119
Frankel, Norman 277
Friedman, Howard 221
Gilmer, B. von Haller 3
Golden, Beverly 85
Goldstein, Allan C. 165
Handel, Gerald 199
Hare, A. Paul 51
Hare, Rachel T. 51
Hess, Robert D. 199
House, Betty J. 183
James, W. T. 127
Kerr, Willard 277
Lebo, Dell 231
Luchins, Abraham S. 153
Maier, Norman R. F. 35
Mech, Edmund V. 263
Miller, R. E. 119
Moyer, Kenneth E. 3
Murphy, J. V. 119
Passey, George E. 27
Passenti, Richard G. 27
Preston, Anne 239
Quinn, Marian 95
Richardson, Helen M. 251
Rose, Grace 277
Salzinger, Kurt 133
Schpoont, S. H. 85
Schultz, R. E. 11
Simpson, A. D., Jr. 213
Simpson, Ray H. 95
Smith, Walter D. 105
Steinberg, Frederick 165
Stern, John A. 141
Surko, Elise F. 251
Warren, J. M. 61, 65
Wertheimer, Michael 281

[illegible] Edn. [illegible]
3.7.70
J- 311

TABLE OF CONTENTS

Experimental study of children's preferences and use of blocks in play . . . 3
By Kenneth E. Moyer and B. von Haller Gilmer

The effect of time on spontaneous alternation in the rat 11
By Allen D. Calvin, R. E. Schulz, and L. Thomas Clifford

The effect of conditioned stimulus intensity upon a simple running response 27
By George E. Passey and Richard G. Possenti

Studies of abnormal behavior in the rat: XXIV. Position habits, position stereotypes, and abortive behavior 35
By Norman R. F. Maier and Paul Ellen

The draw-a-group test 51
By A. Paul Hare and Rachel T. Hare

Acquisition of successive and simultaneous discrimination habits by cats . . 61
By J. M. Warren and A. Baron

Intertask transfer in code substitution learning 65
By J. M. Warren

A search for systematic personality differentiae of the only child in young adulthood 71
By Maurice O. Burke

Prestige suggestion in children's art preferences 85
By D. P. Ausubel, F. DeWit, Beverly Golden, and S. H. Schpoont

Synesthesia in children: Association of colors with pure tone frequencies 95
By Ray H. Simpson, Marian Quinn, and David P. Ausubel

Sex-rôle learning of five-year-olds 105
By Lydia Boyce Fauls and Walter D. Smith

Spontaneous recovery of an avoidance response over an extended time interval in the monkey 119
By J. V. Murphy, R. E. Miller, and D. V. Finocchio

The geotropic reaction of newborn puppies 127
By W. T. James

BOOKS 131

CRITICAL REVIEWS OF RECENT BOOKS 133

Edwards, A. L. *Statistical Methods for the Behavioral Sciences.* (Reviewed by Kurt Salzinger) 133

BOOKS RECENTLY RECEIVED 137

The effect of a series of electroconvulsive seizures on some measures of activity in the male albino rat 141
By John A. Stern

A functional approach to clinical psychology 153
By Abraham S. Luchins

Experimental inhibition and restoration of mating behavior in male rats . . 165
By Frank A. Beach, Myron W. Conovitz, Frederick Steinberg, and Allan C. Goldstein

The relationship of place and turn alternation to reactive inhibition . . 183
By Betty J. House

Patterns of aggression in parents and their children 199
By Robert D. Hess and Gerald Handel

Electroconvulsive shock and the learning of visual patterns 213
By W. Lynn Brown and A. D. Simpson, Jr.

The structural aspects of schizophrenic responses to auditory stimuli . . 221
By Howard Friedman

Age and suitability for nondirective play therapy 231
By Dell Lebo

An assessment of personal-social adjustments of a group of middle-class mothers 239
By Vaughn J. Crandell and Anne Preston

WISC scores and status in reading and arithmetic of delinquent children . 251
By Helen M. Richardson and Elise F. Surko

Trends in the "fears and worries" of school children as related to socio-economic status and age 263
By Henry Angelino, Joseph Dollins, and Edmund V. Mech

SHORT ARTICLES AND NOTES 277

Empathic and sociometric status among young teen-agers (Grace Rose, Norman Frankel, and Willard Kerr) 277

BOOKS 279

CRITICAL REVIEWS OF RECENT BOOKS 281

Werner, Heinz, Jr., *Ed.* *On Expressive Language.* (Reviewed by Michael Wertheimer) 281

BOOKS RECENTLY RECEIVED 283

The Journal of Genetic Psychology, 1956, **89**, 3-10.

EXPERIMENTAL STUDY OF CHILDREN'S PREFERENCES AND USE OF BLOCKS IN PLAY*

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A. INTRODUCTION

A review of the literature in the area of children's play with blocks shows a dearth of experimental studies. Hulson (7, 8), in a study of the free play of 10 four-year-old children for 18 different kinds of play materials, found blocks held first rank in terms of number of times chosen, number of minutes used, persistence in use, as well as in terms of social values. In a study of 24 additional children, he found that the chief activity with the blocks was building; other activities included knocking down, carrying, and piling them. Of six block shapes used (various sizes of bricks, cubes, and pillars) the 4″ x 2″ x 2″ brick held first preference. Hulson also found that the number of blocks at home and the amount of their use seemed to have little relationship to their popularity of use at school. Van Alstyne (17) found that blocks ranked high in choice among 25 different play materials for preschool age children. Cockrell (3) and Gutteridge (6) found blocks to be of only intermediate rank among preferences of play materials in a free choice situation. Vance and McCall (18) found blocks low in preference of preschool children when determined by the method of paired comparison of pictures. Bott (2) found large blocks ranked higher in frequency of use with nursery school children than did small blocks. Farwell (4), in a study of kindergarten, first and second grade children, found that girls ignored block play when given opportunity for sewing; boys always chose the blocks. Updegraff and Herbst (16), in a study of the social behavior of two- and three-year-old children, found that coöperation behavior occurred more frequently during play with clay than during play with blocks.

Krötzsch (10) observed the development of block building in one child from the age of two years, eight months through five years, six months. He found that at first a building concept in the child did not exist, the selection of blocks being completely without plan. This stage was followed by one in which the child chose blocks according to size and shape, carefully placing

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*Received in the Editorial Office on October 22, 1954.

[1]This investigation was supported by a financial grant from the Educational Toy Institute of New York.

them in a row side by side or in a pile. Purposeful building came as a third stage through attempts to imitate forms in the environment. Finally, the child devised his own creative structures. The development of space forming went through four steps: the use of a single block as an entire structure, building walls, enclosing space in the form of ground plans, and roofing or covering of space. The child showed an increasing emphasis on symmetry until he reached the stage of purposeful building.

Bailey (1), using the method of equal appearing intervals, had 100 adults rate photographs of the block constructions of 44 nursery school and kindergarten children. She found that with increasing age the child tends to develop an increasing ability to plan and carry out a plan, design symmetrically, and place blocks more carefully. Guanella (5), in a study of 66 children, aged one through six years, observed that in the beginning the manipulation of blocks seemed to require little more than motor skill and hand-eye coördination. Gradually kinesthetic and visual impressions were acquired that formed the foundation for more mature uses of blocks. At 97 weeks of age, hand-eye coördination played a large part in the use of blocks. Language began to function around 110 weeks. As buildings became more complex and detailed, so did language. She concluded that the use of blocks depended in large measure on the development of space relations in the subjects.

Typical of the writings on the values of blocks in the classroom are those of Layman (11), Salisbury and Ivey (13), and Tarrants (14). Trace (15) and Johnson (9), in their books on block building, describe and show pictures of the many kinds of structures children make with blocks.

B. STATEMENT OF PROBLEM

For the most part the studies of children's use of blocks in play as reported in the literature have been confined to descriptive observations. This investigation deals with a quantitative study of the preferences of preschool age subjects of block shapes and sizes for play in a relatively non-distracting situation, the frequency of individual block usage, and a measurement of attention spans. The study includes an analysis of the block structures built by children in the three-, four-, and five-year-old brackets to determine if there are differences in block play relative to age.

C. EXPERIMENTAL PROCEDURES

A total of 87 children were used in this study: 14 boys and 13 girls in the three-year age range and 30 subjects each in the four- and five-year age brackets, equally divided as to sex. The children came from families in the middle socio-economic range and all were making a normal adjustment. All observations reported in this study were made on one child at a time in the laboratory, with only one observer in the immediate vicinity of the child.

The laboratory playroom was equipped with a rug. The walls were decorated with nursery plaques, the windows with drapes. The only furniture in the room was an observer's chair and table. Off by one end of this playroom was an observation room with a three- by five-foot one-way viewing window built into the wall. Behind this one-way window, camera equipment was installed for taking pictures of the subject and his block building in various stages of construction. These pictures were made by a second observer. The laboratory was well isolated from noise and other distractions.

Each subject was picked up from his home and brought to the laboratory by one of the observers, who first spent enough time with the child in his own environment to get acquainted with him and establish rapport. The child was then taken to the laboratory and allowed to explore the play environment. When it was apparent that he was at ease in the situation, the observer introduced a set of 300 blocks placed in a random pile in the center of the room. The observer then asked, "Would you like to play with these blocks while I do some work over here?"

From this point on during the block play session, the room observer made a complete record of everything the child did or said, and did not initiate any conversation with the child until after he had finished a block building task. If by this time the subject had not named the structure he had built, the observer said, "Tell me about what you built." The observer would answer questions specifically directed at her, but in a friendly way tried to discourage conversation. At no time did the observer play with the child. If the subject requested help with the block building, the observer simply told him she was sure he could do it himself.

The length of time the child played with the blocks was taken by stop watch. The play session was terminated when the child left the blocks for a period of one minute. An arbitrary time limit of 45 minutes was set for the termination of any play session. The second observer stationed behind the one-way window took still pictures of each step the child made in his block building.

Each subject had available the same assortment of 300 unpainted yellow pine wooden blocks of 10 different shapes and sizes, 30 of each kind. For the most part these blocks were similar to those recommended by Trace (15) for nursery and classroom use. The blocks included: flat rectangles (9″ x

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6″ x ⅛″), square blocks (2¼″ x 2¼″ x 1⅛″), short blocks (4½″ x 2¼″ x 1⅛″), long blocks (9″ x 2¼″ x 1⅛″), thin long blocks (9″ x 2¼″ x ½″), square pillars (4½″ x 1⅛″ x 1⅛″) round pillars (4½″ x 1⅛″), arches (4½″ x 2⅛″ x 1⅛″), half-circles (2⅞″ x 1⅛″), and triangles (3⅛″ x 1⅛″ x 1⅛″).

D. Results and Discussion

The results of this study show that three-, four-, and five-year-old children had rather consistent preferences in choice of block shapes and sizes for use in building construction. Each age group showed first preference for the "flat rectangle" and second choice for the "arch." There was some degree of consistency among the three ages for the "long block" and "thin, long block" as third and fourth choices. The block chosen least by each of the three age groups was the "triangle." There was no consistency in preference, or lack of preference, for the other block shapes from age to age.

The frequencies of different block uses are given in Table 1. The first column shows the mean number of each of the 10 types of blocks drawn from the supply pile of 300 blocks and used in block play. These data are tabulated by ages. The second column of this table shows the mean number of uses and reuses of any given block. For example, a child might select four "flat rectangles" for his first structure. For the second structure he might take two more flat rectangles, and reuse one from the first structure. Thus he would have drawn, would have used and reused seven "flat rectangles." The third column of Table 1 shows the number of children not using any of the given blocks. The last column tabulates the number of children using all 30 of any given block.

Table 2 presents a summary of the mean number of structures built and the mean number of blocks used in the building in relation to age. The older children made more structures. However, as can be seen from Table 2 there was a decrease in the number of blocks used per structure by the five-year-old group. None of the differences between age groups shown in this table were found to be statistically significant from a straight line save those for the mean number of "name" structures. No significant sex differences were found for any of the data.

There was a greater variety of names given the structures by the older children. Three- and four-year-olds gave a total of 34 and 38 different names, respectively, to the structures they had made. The five-year-olds gave 54 names to their structures. The names given more frequently by all three ages were "house," "tunnel," and "bridge."

TABLE 1
Individual Blocks Used at Different Ages

	Mean number blocks drawn and used			Mean number uses and reuses of blocks			Number children not using given block			Number children using all 30 of given blocks		
	3 Yrs.	4 Yrs.	5 Yrs.	3 Yrs.	4 Yrs.	5 Yrs.	3 Yrs.	4 Yrs.	5 Yrs.	3 Yrs.	4 Yrs.	5 Yrs.
Flat Rectangle	9.9	16.0	12.0	14.1	23.1	19.5	4	1	1	3	9	6
Square Block	2.4	4.6	6.3	3.1	6.3	6.3	11	12	11	0	0	1
Short Block	4.9	5.1	4.0	8.2	7.0	4.3	6	8	12	1	0	0
Long Block	7.2	7.8	9.2	11.6	10.4	13.1	4	3	5	1	0	1
Thin Long Block	6.1	8.5	7.5	9.7	10.9	10.2	3	3	5	2	0	1
Square Pillar	4.6	5.2	6.6	6.7	8.0	9.0	7	13	10	1	1	1
Round Pillar	3.7	7.0	5.6	4.7	9.0	7.6	5	5	9	0	0	0
Arch	8.6	9.2	10.1	12.4	12.0	16.0	2	5	2	0	2	0
Half-Circle	5.3	4.9	5.5	7.2	6.8	9.5	5	7	6	0	0	0
Triangle	2.3	2.4	3.5	2.7	3.6	4.5	8	9	10	0	0	0

The mean attention spans in minutes were 22.3, 25.3, and 28.8, respectively, for the three-, four-, and five-year-old subjects. These times scores for play with the blocks are lower than the mean attention spans of the same aged children obtained by Moyer and Gilmer (12) for experimentally designed toys. It should be pointed out, however, that the toys had been designed and redesigned to obtain "maximum holding power" whereas the blocks used in this study had not been redesigned for the purpose of increasing the attention spans.

TABLE 2
AGE DIFFERENCES IN CONSTRUCTION

	3 Yrs.	4 Yrs.	5 Yrs.
Mean Number Structures Built	4.2	5.1	5.7
Mean Number "Name" Structures	2.8	3.2	4.9
Mean Number "No-Name" Structures	1.4	1.9	0.8
Mean Number Blocks Used in All Structures	54.2	70.7	70.9
Mean Number Blocks Used per Structure	22.2	22.3	19.7

Of the structures built by the children it was evident that there were a larger number of symmetrical designs made by the older children and the blocks were placed with more care. However, the structures made by some three-year-olds were better in design than those made by most of the children in the five-year age range. There was just as much random piling or stacking of blocks by the older children as there was among the younger ones. It was impossible to judge with any degree of accuracy what types of structures were made by what age subjects when judged only from photographs.

Our data do not support a contention that there are "stages" (related to age) in the selection and use of blocks in building. It may well be true that any one child passes through various stages from planless selection, to choosing blocks on basis of size and shapes, to purposeful building as Krötzsch (10) described, but we did not find from our cross-sectional studies that there was any more "planless selection" of blocks at three years of age than there was at five years. The three-, four-, and five-year-olds showed consistency in first, second, third, and fourth choices of blocks. We found three-year-olds who would use a single block as an entire structure, but so did four- and five-year-olds. We found the younger children choosing blocks of the same size and shape, placing them in rows or piles; but the older children did likewise. Individual differences in the design of structures were just as great within any given age bracket as the differences found between the different age groups.

Our interpretation is that the children's choices of blocks for building were made on the basis of their utility rather than because of some aesthetic appeal. The "flat rectangle" rated first choice at all ages because it was useful in making floors, walls, and roofs, and provided good support for other blocks. The "triangle" was preferred least because its utility was limited. It is interesting to note that most commercially available block sets do not include "flat rectangles" but do include a generous supply of "triangles." In assembling a useful block set, consideration should be given not only to the selection of blocks according to size and shape, but also to how well the blocks work out in combination for building.

E. Summary and Conclusions

For the most part previous studies of children's use of blocks in play have been confined to descriptive observations. This investigation deals with a quantitative analysis of the preferences of 87 three-, four-, and five-year-old children for block shapes and sizes used and reused in building construction. It was found that the subjects' preferences for blocks were not related to age. Whereas it has been contended from longitudinal studies that children pass through "stages" in their selection and use of blocks, our cross-sectional studies do not indicate that this is necessarily related to chronological age. Three-year-olds made their selection and use of the blocks in essentially the same ways as the older subjects. Individual differences in the design of structures were just as great within any given age bracket as the differences found between the different age groups. We interpret that the subjects' preferences for block shapes and sizes were made on the basis of their utility in being combined together for building.

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The Journal of Genetic Psychology, 1956, **89**, 11-25.

THE EFFECT OF TIME ON SPONTANEOUS ALTERNATION IN THE RAT*

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A. Introduction

Although Tolman (21) and other early investigators noted that rats showed a tendency to alternate in free choice situations, the first systematic investigation of this phenomenon was made by Dennis and his associates (2, 3, 4, 24) in the thirties. During the next decade only a few studies appeared in the literature (8, 9, 22, 23). However, recently there has been a resurgence of interest, and a number of provocative experiments (6, 10, 11, 12, 13, 14, 15, 16, 17, 25, 26) have appeared.

Concomitant with the renewed interest in experimentation on the problem of alternation, a number of theoretical models to explain this and other related phenomena have been published. These explanatory models range from Montgomery's exploratory drive (12) and Glanzer's stimulus satiation (7) to neo-Hullian explanations such as those proposed independently by Zeaman and House (26) and Saltz (18).

Almost all the experimenters working in this field have recognized the importance of time in relation to the tendency to alternate, and the various theoretical models mentioned above have also taken temporal factors into account. However, in the opinion of the present authors certain crucial relationships have not been adequately investigated. The present experiment is designed primarily to study the effect of one trial a day learning and other experimentally controlled temporal variations on spontaneous alternation in the rat.

B. Apparatus and Procedure

The *S*s were 36 male naïve albino rats, approximately 90 days old, from the colony maintained by the Michigan State College Psychology Animal Laboratory. During the course of the experiment two *S*s were discarded.

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*Received in the Editorial Office on October 22, 1954.

[1] This study was aided by a grant from the Michigan State College All College Research Fund.

The authors are indebted to Robert Lyon for his assistance in the collection of the data.

One was eliminated because of an error made by an *E*, and the other because of illness. A total of 34 *S*s completed the study.

The apparatus consisted of a hollow square maze with a straight alley, 12 inches long, leading from the start box to the choice point. The arms were 13 inches long and extended forward for 3 inches at their extremities and turned inward again for 13 inches to meet at a common entrance to the goal box. The start box was 8 inches long by 7½ inches wide, and the goal box was 17 inches long by 7½ inches wide. The alleys were 4½ inches wide with walls 4½ inches high. Guillotine doors were so placed that it was possible to block off the start box, goal box, and either side of the maze.

The *S*s were divided into two groups. Group I consisted of 20 *S*s. These *S*s were maintained on a 24-hour feeding schedule for 10 days previous to the experiment during which time they were handled and fed in the goal box. On the first day of the experimental trials one arm of the maze was blocked off and the *S* was allowed to run down the maze to the goal box where it received Purina dog mash as a reward. *S* was allowed 15 seconds in the goal box before being returned to the start box for another trial. Each *S* was given 10 trials per day and then returned to its home cage where it was fed nine grams of Purina checkers and kept on approximately a 24-hour hunger drive throughout the experiment. Half the *S*s had the left side of the maze blocked and half the right. The *S*s were assigned to the conditions randomly. The same side remained blocked for any particular *S* throughout the experiment. During the first few trials it was occasionally found necessary to poke an *S* with a piece of wire, but this was terminated early in the training, and by the time of the test trial all the *S*s were running freely and rapidly. On the first trial of the fifth day, the 41st experimental trial, the door of the previously blocked side was left open and *S* was free to go in either direction at the choice point.

Group II originally consisted of 16 *S*s; however, two were discarded for reasons mentioned previously which gave us an actual *N* of 14. They differed from Group I in that they had only one trial per day for 40 days. On the 41st day the door of the previously blocked side was opened and a free choice was possible.

C. Results and Discussion

The results for the two groups on the test trial are presented in Table 1. The Group I *S*s' tendency to choose the previously blocked alley was significant beyond the 5 per cent level using the two-tailed binomial expansion. Group II *S*s showed a very slight and statistically insignificant tendency to prefer the unblocked alley.

Our findings can be handled quite nicely by utilizing Hull's constructs and Spence's generalization gradients. It will be assumed that the reader is familiar with the Hullian system as space prevents us from defining in detail the symbols used in our discussion. We will analyze the results for each group separately and then make some comparisons.

TABLE 1
NUMBER OF RATS ALTERNATING ON TEST TRIAL

	Alternating	Non-alternating
Group I	15	5
Group II	6	8

Each time a Group I *S* ran down the alley it acquired a unit of *sHr*, a unit of *Ir*, and a unit of *sIr*. Since the trials were closely massed, a good deal of *Ir* and *sIr* was built up. On the test trial when the door was removed exposing the previously blocked path, *sHr* and *sIr* generalized from the previously traveled side to the new side. Figure 1 presents for Group I hypothetical generalization gradients similar to the ones postulated by Spence (19). Since *D* was held constant, in order to determine the relative probability of response to the two respective sides we simply subtract the *sIr* from the *sHr* (disregarding *Ir* because there was a 24-hour interval between the last experimental trial and the test trial). The probability of response for the "old" previously unblocked alley and the "new" previously blocked alley is represented by their respective portions labeled *p* in Figure 1. Since the *p* value for the new previously blocked alley is greater than that of the old previously unblocked alley, we would expect the Group I *S*s to choose the new alley. These expectations were of course supported by our findings.

Our analysis for Group II essentially parallels that made for Group I, the one crucial difference being the spacing of the trials. Since there was a 24-hour interval between trials, only a small amount of *Ir* and *sIr* would be acquired. Figure 2 presents the generalization gradients for Group II. The *sHr* gradient is the same as the one for Group I presented in Figure 2. The *sIr* gradient is much less pronounced due to the spacing of the trials mentioned previously. When we compare the *p* value for the two alleys in this situation we find that they are very similar. We would expect then that the *S*s of Group II would respond more or less randomly. These expectations were also supported by our results as noted above.

Although our explanation handles the empirical findings nicely, one obvious objection can certainly be legitimately raised. The points on the generalization gradients were assigned after the data had been collected; therefore, couldn't we have handled any results we obtained by merely shifting the shape of our gradients or putting in our points at a different place in the curve? We actually had made our predictions before the experiment began, but that is incidental. The important facts as far as we are concerned are (*a*) using Spence's gradients enables us to explain our findings, and no other contemporary theoretical model which has appeared in the literature can do so. (*b*) By using these gradients and the Hullian assumptions mentioned earlier we can reconcile seemingly discrepant findings reported by other experimenters. (*c*) New predictions flow from our model which are in direct contradiction to those of other contemporary theorists and will allow us to determine empirically the value of our explanation.

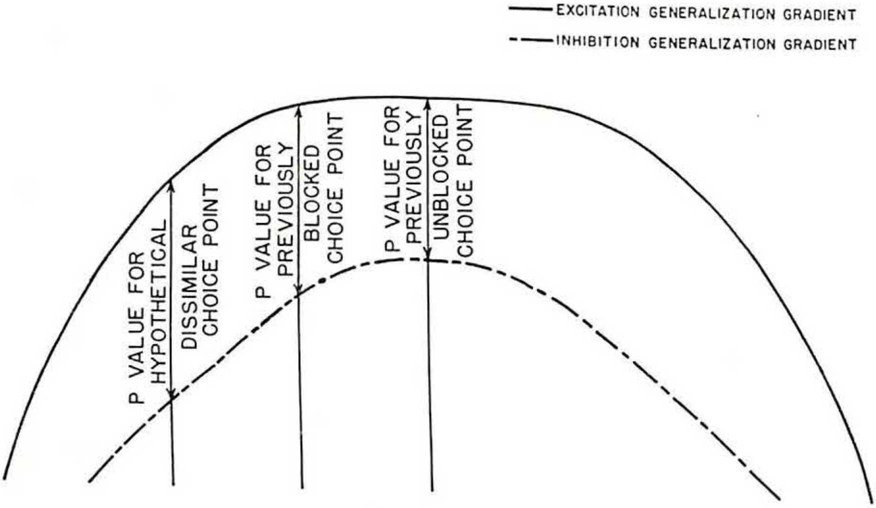
EXCITATION GENERALIZATION GRADIENT
INHIBITION GENERALIZATION GRADIENT
P VALUE FOR HYPOTHETICAL DISSIMILAR CHOICE POINT
P VALUE FOR PREVIOUSLY BLOCKED CHOICE POINT
P VALUE FOR PREVIOUSLY UNBLOCKED CHOICE POINT

FIGURE 1
HYPOTHETICAL GENERALIZATION GRADIENTS FOR GROUP I

The above three points, (*a*), (*b*), and (*c*), cannot be left standing alone and unsubstantiated. In the interests of clarity, we will present our evidence for each of them separately.

In point (*a*) above we maintained that no other contemporary theoretical model could adequately account for our results. We feel that a brief glance at these models will substantiate our claim. Montgomery has posited an "exploratory drive" to handle spontaneous alternation. One of Montgomery's basic postulates is as follows (13, p. 50): "It is postulated that after a period of exposure to a stimulus situation, the strength of the exploratory tendency evoked by that situation recovers during a period of nonexposure." Montgomery goes on to state (13, p. 56): "The data confirm the postulated relation between strength of exploratory tendency and time of nonexposure to a stimulus situation: both groups showed complete recovery in amount of exploratory behavior after a 24-hour rest period. Thus, strength of exploratory tendency decreases during a period of exposure to a simple maze and recovers during an ensuing period of nonexposure." If the imbalance in "exploratory drive" created by exposure to a particular stimulus condition disappears in 24 hours as predicted by Montgomery, then our Group I animals should have performed randomly. Instead of course they chose the previously blocked side at a statistically significant level indicating considerable carry over after a 24-hour interval. The inability of Montgomery's model to handle our findings raises serious question as to the scope of its application.

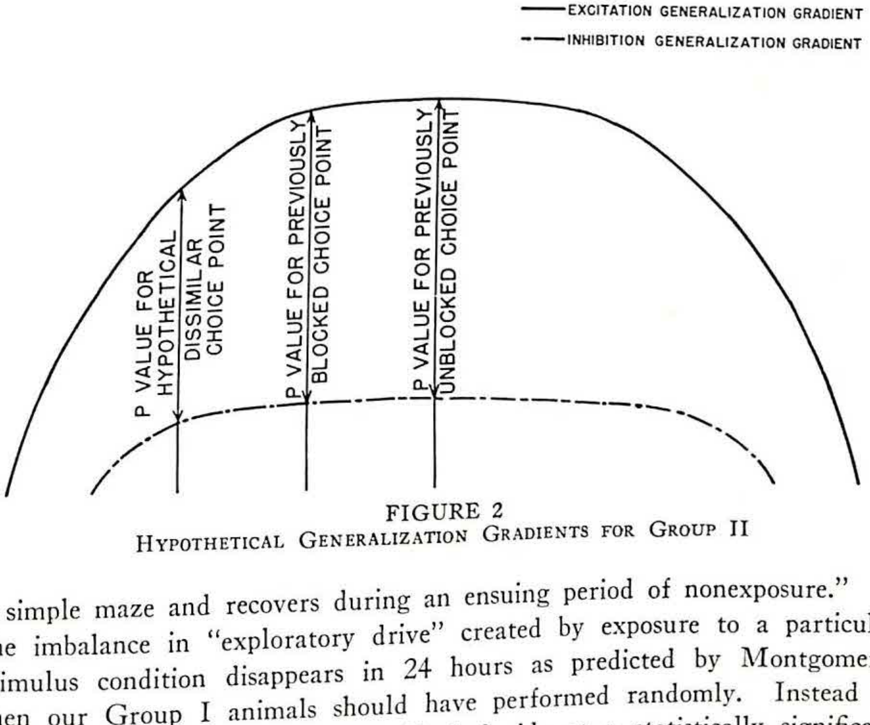
EXCITATION GENERALIZATION GRADIENT
INHIBITION GENERALIZATION GRADIENT
P VALUE FOR HYPOTHETICAL DISSIMILAR CHOICE POINT
P VALUE FOR PREVIOUSLY BLOCKED CHOICE POINT
P VALUE FOR PREVIOUSLY UNBLOCKED CHOICE POINT

FIGURE 2
Hypothetical Generalization Gradients for Group II

Glanzer attempts to handle spontaneous alternation in terms of "stimulus satiation." The crux of his exposition is presented as follows (7, p. 259): "Corollary I. As long as an organism remains perceiving *A*, the amount of stimulus satiation it has to *A* at a given moment (that is, the total amount developed i minus the total amount lost ii), is an increasing negative exponential function of time. Corollary II. When an organism stops perceiving *A*, the amount of stimulus satiation it has to *A* at a given moment is a decreasing negative exponential function of time." In Glanzer's Table 1 (7, p. 260) he presents us with a method for obtaining values for stimulus satiation as follows: $I_n = 100\ e^{-(n-1)}$ (where *n* is the number of moments since the appearance of the stimulus). Since our Group I *S*s spent approximately four minutes in the stimulus situation, we used minutes as our temporal unit, and utilizing values presented by Glanzer we find that at the end of four minutes exposure time to the stimulus an *S* would have 155.3 units of stimulus satiation. We remove *S* from the stimulus situation and after only four minutes of non-stimulation *S*'s stimulus satiation has dropped to 2.9. After a 24-hour period an animal would have $100\ e^{-1439}$ of a unit of stimulus satiation (a figure so infinitesimal that one of my colleagues from the mathematics department, Professor Leo Katz, informs me that it would take 622 zeros beyond the decimal point before you even arrive at a positive integer). Glanzer has unfortunately not stated the specific limen for stimulus satiation to be effective, but it seems highly unlikely that he would assume that $100\ e^{-1439}$ of a unit of stimulus satiation for one alley would be enough to force *S* to choose another alternative. Such an assumption reduces the model to absurdity for an *S* exposed to a given stimulus situation for a split second would build up enough stimulus satiation to force it to choose the opposite alternative. Of course these numbers are merely hypothetical, and he could add a constant or manipulate them in some other fashion so that there would be a considerable amount of stimulus satiation left even after 24 hours of non-exposure to the stimulus situation. However this does such violence to the rationale for the model and leads to so many difficulties in the handling of other findings that the value of such manipulations is difficult to perceive.

Saltz (18) has constructed "A Single Theory for Reminiscence, Act Regression, and Other Phenomena." One of the "other phenomena" which is treated briefly by Saltz is spontaneous alternation. Saltz's model is similar to ours in that both make use of Spence's generalization gradients; however, Saltz does not use the Hullian constructs of *Ir* and *sIr* as we do. Instead he has inhibition developing on non-rewarded responses and excitation developing on rewarded ones. Actually one cannot really say that Saltz cannot account for our findings as his model simply is not broad enough to handle an experimental situation such as ours. Since Saltz was only peripherally interested in spontaneous alternation this is certainly an understandable deficiency. However, in his short analysis of spontaneous alternation which we are going to quote we feel that he himself has indicated the inadequacy of his own position. He states on page 164:

> Dennis (2) reports that when animals are given two alternative paths of equal length, both paths ending in reward, the animals will show a greater-than-chance tendency to avoid the path chosen on the preceding trial. The longer the paths are made, the stronger the alternation tendency becomes. This is a reasonable result, in terms of the theoretical model presented above. Delay of reward is a point along the reward-no-reward continuum. In fact, any response is eventually followed by some reward, though this reward may not arise until hours after the response has been made; in such a situation the reward may probably be considered as not effective for reinforcing the particular response. Thus, a choice point followed by a long path to reward should result in inhibition accruing to the path chosen; if the two alternative paths are similar in appearance at the choice point, both the rewarding and inhibiting properties of the chosen path will generalize to the previously ignored path. Since inhibition generalizes less than reward, the previously ignored path will have a greater *E-I* strength than the previously selected path.

An interesting and valuable deduction. Unfortunately Saltz's belief that Dennis reported "The longer the paths are made, the stronger the alternation tendency becomes" is in error. Dennis' actual findings were as follows (3, p. 308):

> In Group *A*, each rat was first given 24 pairs of trials on the simple unit, yielding 480 possible alternations. Of these 82 per cent were realized. Next, 14 feet of goal pathway were added and 6 pairs of runs given. Then 24 feet of pathway were employed and 5 pairs of trials were conducted. Finally the goal path consisted of 38 feet of pathway and 14 pairs of runs were required of each animal. The percentages of alternation for these trials were respectively 72, 78, and 76. In other words, the time required for running 38 feet of additional pathway plus the interval needed to carry the animal back to the starting point, did not appreciably affect the influence of the first choice upon the second.

Since Saltz felt that the results he reported were in accord with his model, and since the actual experimental findings were not at all what Saltz thought them to be, this seems to indicate the need for some radical revision in his theoretical conceptions at least as far as spontaneous alternation is concerned.

Zeaman and his associates (17, 25, 26) have attempted to use the Hullian construct of *Ir* to explain spontaneous alternation; however, as they themselves noted, they encountered considerable difficulty. They were finally forced to conclude (17, p. 244): "Reactive inhibition ('tired response') principles failed to account for all the data as did a stimulus adaptation ('tired stimulus') theory. A composite of these two views, however, was found adequate to account for the findings in a qualitative way." Since *Ir* is assumed to dissipate within a relatively short period of time, they of course could not explain the performance of our Group I animals who showed significant alternation after a 24-hour interval.

Authors such as Glanzer and Montgomery have listed a number of studies which they felt could not be handled by "Hull-influenced" response oriented theories. We feel as noted in point (*b*) that our Spence-type model can account for all the data now available pertaining to spontaneous alternation. A brief examination of the studies mentioned by Glanzer and Montgomery should enable us to test the validity of our claim.

Glanzer (7) lists five studies which he felt could not be adequately accounted for by a response oriented theory. The first of these is the study by Dennis which we mentioned earlier in another context. Glanzer states (7, p. 258):

> Dennis (5) found that rats did not show spontaneous alternation from unit to unit of a multiple-unit maze. That is, they did not go right-left-right-left within a single trial on a four-unit maze, but showed instead spontaneous alternation in their successive choices at a given choice point. They might go right-right-right-left on the first trial and left-left-left-right on the second trial. This finding is in direct contradiction to the prediction which should follow from a theory in terms of the response.

In the first place Dennis simply didn't report these findings. Instead he reported that when there were over two choice points in a multiple unit maze that the trial by trial alternation which he found in the two choice maze broke down. Glanzer's statement that ". . . they did not go right-left-right-left within a single trial on a four-unit maze, but showed instead spontaneous alternation in their successive choices at a given choice point" is in direct contradiction to what Dennis reports. Moreover the confounding of variables involved in a multiple unit discrimination apparatus as noted by Spence (20) and verified by Calvin and Seibel (1) make any critical analysis of experiments run on such apparatus difficult if not impossible.

The second study mentioned by Glanzer is one conducted by Jackson (9). Glanzer states on p. 258:

> Jackson (11) found that the difference between the two possible responses at the choice point did *not* affect the amount of spontaneous alternation. A *Y* maze with a small angle of separation, requiring

> a choice between two practically identical responses, elicited as much spontaneous alternation as a *Y* make with a wide angle of separation. If the response were the key to spontaneous alternation, then differentiating the response should result in more alternation.

Glanzer is correct as far as he goes; however he neglects to mention two facts. First, Jackson had found that when he increased the angles on two wooden strips (laid across a Lashley jumping stand to allow the animals to walk across rather than jump) alternation increased from 8 per cent to 28 per cent. This prompted him to run the animals in the *Y* mazes with various angles of separation mentioned by Glanzer. It is true, as Glanzer stated, that Jackson found that the angular separation made no difference in the amount of alternation; however Glanzer seems to have overlooked the reason for this as reported by Jackson as follows (9, p. 259): "The rats alternated in over 90 per cent of the trials irrespective of the angular separation." With alternation over 90 per cent in the case of Jackson's smallest angle it would of course be impossible to achieve any marked differences in alternation due to angular separation. Recently a more sensitive test of a related hypothesis was conducted by Zeaman and Angell (25) with results which seem to conclusively demonstrate the existence of a strong relationship between spatial gradients and alternation.

The third study mentioned by Glanzer is one conducted by Zeaman and House (26). Glanzer states on p. 258: "Zeaman and House (23), using a procedure of ten forced trials followed by a free trial, and Walker (2), using simply two free trials, found that rats showed spontaneous alternation with intervals greater than an hour between trials. These findings disagree with expectations on the basis of reactive inhibition which is ordinarily assumed to dissipate within a few minutes (3)." Since we make use of the concept of *sIr* which does not fade, we cannot only account for the findings of Zeaman and House, and Walker, but we would predict them beforehand.

The fourth study is one conducted by Wingfield. Glanzer states on page 258: "Wingfield (21) found that human subjects showed more spontaneous alternation in choice of lights that differed in color than of lights that were the same. Something in addition to consideration of the subject's responses seems to be demanded by this finding." Although our model primarily concerns itself with sub-human behavior, because of the complications introduced by mediating responses, etc., we not only take into account stimulus differences, we state under what conditions stimulus similarity will promote alternation and when it will act to prevent alternation. (See the discussion of point (*c*) below.)

The last study discussed is one by Dennis (3). Glanzer remarks on p. 258: "Dennis (5) varied the amount of work for rats running a maze by increasing the length of the final section from zero to 38 ft. but found no change in the amount of spontaneous alternation. It would seem reasonable to expect that the reactive inhibition from the added run of 38 ft. should dwarf the effects of reactive inhibition from the momentary act of turning right or left." In this study two factors were operating in direct opposition to one another. The factor of increased work in the longer maze should have operated to increase alternation; however, the increased distance would act to weaken the *sIr* connection because of the corresponding greater temporal lag between the choice point stimuli and the cessation of activity, thus militating against the alternation tendency. Because of the confounding of these two factors, it is impossible to make a clear-cut prediction. However Zeaman and House (26) report that in an unpublished study Solomon found that an increase in response work increases alternation—a finding that is in accord with our expectations providing confounding factors have been eliminated.

Besides these studies which we have discussed above, certain "place alternation" studies (6, 14, 17) have been offered as evidence against theories utilizing the Hullian constructs to explain alternation. Although these experiments differed in several respects the basic paradigm is as follows: First the animal traverses one side of a simple *T* maze, e.g., left towards the east wall of the room. On the test trial change the experimental setup in such a manner that the cues are placed on opposing sides, i.e., the hypothetical animal mentioned above might have his maze rotated so that the east wall of the room is on the right. If the animal goes to the right then he is alternating turns. If he goes to the left this is ascribed to place alternation. Of course there are several variations on this design such as having the animal turn left on a white alley and then place the white alley on the right and a black alley on the left, and if the animal goes right he is assumed to be alternating turns while if he goes to the left this is assumed to be place alternation. Although the magnitude of place alternation reported varies from study to study all of the experimenters report statistically significant amounts.

By utilizing the *sIr* construct as we have done these findings not only can be explained but are predicted in advance. Since all the stimuli that are around when a response ceases and *Ir* is reduced acquire a tendency to call forth "not doing" responses or *sIr*, not only are the proprioceptive stimuli or stimuli traces from turning conditioned to "not doing" but also visual stimuli such as the east wall or white alley also acquire *sIr* properties. Thus one would expect both place avoidance and turn avoidance when the experimental conditions are arranged in the manner mentioned previously. Whether place avoidance or turn avoidance will dominate depends of course on the particular experimental setup utilized.

Rothkopf and Zeaman (17) investigated some of these factors in a comprehensive experiment referred to previously. They actually report on four separate experiments which unfortunately space does not permit us to analyze in detail. We have selected Experiment One because it seems most relevant to the point at issue. Rothkopf and Zeaman divided their *S*s into three groups. The *S*s in the *FN* group were forced in one direction and then on the free choice trial the new arm was of a different brightness. The *S*s in the *FF* group were forced in one direction, and then on the free choice trial both the previously blocked arm and the new arm were of the same brightness. The *S*s in the *NF* group were forced in one direction and then on the free choice trial the previously blocked arm was of a different brightness from the forced trials while the new arm was the same brightness as the arm used on the forced trials. Our prediction would be that since the *FN* group had both the place avoidance and turn avoidance factors operating to favor alternation this group should show the greatest amount of alternation. The *FF* group has only the turn avoidance operating or at least the place avoidance factor has been minimized considerably, and therefore they should show less alternation than the *FN* group. The *NF* group has turn avoidance operating for alternation and place avoidance operating in opposition to alternation of the turning response thus we would expect the smallest amount of alternation to occur in this group. This is precisely what Rothkopf and Zeaman found, although the *FN* vs. *FF* difference was not statistically significant.

Glanzer's (6) finding that the greatest amount of alternation occurs when the animal is confined in the alley chosen on the previous trial as opposed to confining the animal outside the alley last chosen is of course exactly what one would expect when *sIr* is taken into account.

To sum up, both place learning and avoidance learning would be predicted by our model—the amount of each being determined by the particular experimental procedure followed in each case.

In discussing *sIr* Montgomery makes the following comment (15, p. 132):

> Hull's (2) concept of conditioned inhibition is more promising. Essentially, conditioned inhibition is a habit of resting, i.e., of not-responding, which is conditioned to external stimuli. Hence, it would transfer

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> from one stimulus situation to another in accordance with the principle of stimulus generalization. Although conditioned inhibition could account for the generalization effects from one maze to another that occur on any *one* experimental day in the present study, it leads to the prediction that the decrement in exploratory behavior developed in a maze on any one day would transfer to the next day. Unfortunately for this explanation, exploratory behavior in this and other short-term studies (5) shows relatively complete "spontaneous recovery" over a 24-hr. rest period.

Not only does "exploratory behavior" show complete recovery after a 24-hour period, but Montgomery (13) and Zeaman and House (26) found that alternation also shows no carry over after a 24-hour interval. The question now arises as to why we were able to obtain alternation after a 24-hour rest period when Montgomery and Zeaman and House did not. We feel that the most likely reason lies in the difference in procedures utilized in our experiment when contrasted with theirs. Montgomery's animals were allowed to explore the maze freely thus bringing about a relative equalization of *sIr*; so, of course it is to be expected that there would not be any carry over after a 24-hour interval. Zeaman and House attempted to build up large equal habit strengths to both sides of their single *T* maze. They forced their animals for 100 trials to the left and 100 trials to the right in the early part of their experimental procedure to accomplish this purpose. This built up equally strong *sIr* to both arms. Since *sIr* is assumed to grow in a negatively accelerated manner, after so many trials to both sides the added increment would be quite small. With the changes in internal and external stimulation which can be assumed to occur with the passage of as long a time interval as 24 hours, it is not surprising that the stimulus compound was altered sufficiently to eliminate the relatively small *sIr* effect. As noted in the procedure section previously, in order to show the maximum *sIr* effect we did not allow our animals to traverse both sides of the maze before the test trial, and it is this difference in procedure which we feel enabled us to obtain alternation after the 24-hour interval.

In point (*c*) we maintained that our model led to experimentally testable predictions which are in contradiction to those that would be made by other theorists. A number of these predictions have already become apparent in the previous discussion; however one important differential prediction not previously discussed concerns the similarity of the choices available to the *S*. Montgomery notes (15, p. 129): "It is hypothesized (*a*) that the *decrement* in exploratory behavior produced by exposure to one stimulus situation generalizes to other situations, and (*b*) that the magnitude of the generalized decrement decreases as the similarity of the stimulus situations decreases." Glanzer concurs (7, p. 262): "Deduction 5. In the simple two-alternative situation, as stimuli differentiating the alternatives are eliminated, spontaneous alternation will decrease." Saltz takes the opposite position when he states (18, p. 164): "The more the two alleys were dissimilar in appearance at the choice point, the less generalization of either excitation or inhibition there should be between them. Consequently, the alternation tendency should be reduced." Our model makes the prediction that the effect of the stimulus similarity of the two choices will be determined by the shape and height of the generalization gradients and the relative position of the two choice points on these gradients. For example a glance at Figure 1 shows that making a hypothetical choice point more dissimilar, and thereby moving it further away from the original choice point, would have increased its p value and thereby increased the tendency towards alternation. (This of course assumes that the new choice point is not made so extremely dissimilar that it moves away from the original choice point on the generalization gradients to a position where the generalization effect becomes negligible so that the original choice point has a higher p value.)

Figure 2 reveals that in the case of Group II just the opposite prediction would be made. Here making a hypothetical choice point more dissimilar and thereby moving it further away from the original choice point on the generalization gradient would decrease its p value thus decreasing the tendency towards alternation.

Our model thus makes predictions which run directly counter to those of other contemporary theorists. These predictions and others which stem from our model are being tested in our laboratory at the present time.

D. SUMMARY

The present study was primarily intended to study the effects of one trial a day learning and other experimentally controlled temporal variations on spontaneous alternation in the rat. One group of animals, Group I, was given 10 forced trials a day for four days to one side of a hollow square maze. Another group, Group II, was given one forced trial a day for 40 days. Both groups were allowed a free choice on the 41st trial. Group I showed significant alternation while the Group II *S*s performed randomly. A model was presented to account for these findings and the relationship of this model to other contemporary theoretical efforts in this area was discussed.

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The Journal of Genetic Psychology, 1956, **89**, 27-33.

THE EFFECT OF CONDITIONED STIMULUS INTENSITY UPON A SIMPLE RUNNING RESPONSE*

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A. Introduction

Pavlov (10) noted that the size of conditioned responses depended upon the intensity of the conditioned stimuli which called them forth. These results have been confirmed by many investigators in the classical conditioning situation (7, 9) to mention but a few. These experimenters found that the size of resulting conditioned responses is a function of the intensity of the conditioned stimulus, but noted nothing concerning the rate at which the conditioned response is acquired.

Hull (8) has included in his Postulate VI a provision for this stimulus intensity effect. The unpublished experiment of Hays cited by Hull (8) provides evidence for the existence of this effect when response latency is used as an index. This finding supplements previous work on response size.

An experiment by Carter (3) dealt with the effects of varying intensities of tonal stimulus upon the course of acquisition of an eyeblink response. When the number of anticipatory responses for any given level of stimulus intensity was used as an index of performance, the comparison of various stimulus intensities showed no advantage for strong as opposed to weak conditioned stimuli.

Baker (1), attempting to condition the pupillary response to an auditory stimulus of so low an intensity as to be below the threshold of conscious judgment of the subject, found economy in the rate of conditioning when using such a subliminal stimulus in comparison with a supraliminal stimulus. While this finding has been questioned (6, 15), it is of interest to note the study of Newhall and Sears (10) who, employing finger withdrawal, found the frequency of response greatest with stimuli near the individual's threshold.

More recently Grant and Schneider (4) have shown for the wink response a failure of the intensity of the conditioned stimulus to yield a demonstrable effect for both response strength and strength of conditioning. In working with the G.S.R. these same investigators (5) found no demonstrable effect upon strength of conditioning, but in a re-extinction series they did find a significant effect upon response strength. Prior to this work separation of these performance indices had not been attempted. The work of Perkins (13) and Bragiel and Perkins (2) demonstrated stimulus intensity effects for both strength of conditioning and response strength.

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*Receive in the Editorial Office on October 22, 1954.

[1] This research was supported in full by the Research Committee of the University of Alabama.

In the development of a simple running response antecedent to an experiment in discrimination learning in rats our *S*s were exposed to conditioned stimulus intensities of 4, 8, 16, 32, and 64 foot candles. During a 10-day learning series the *S*s received five trials per day. A plot of the learning performance indicated no differences among those groups of animals acquiring the response under stimulus intensities of 8, 16, 32, and 64 foot candles when means of response latencies were used as the indices of performance. The group exposed to a stimulus intensity of four foot candles demonstrated a markedly greater response latency throughout the 10-day learning series. Since the number of *S*s involved was extremely small it was not possible to assess the significance of this finding. Passey and Herman (11) later demonstrated no difference in response strength for animals trained to a stimulus intensity of 64 when compared with a stimulus intensity of 128 foot candles.

B. PROBLEM

The present experiment was designed to assess the differences in response strength in two groups of pigmented rats required to acquire a simple running response under stimulus intensities of 128 and 4 foot candles. Strength of conditioning under the two conditions was examined by subjecting the animals to an extinction series following initial learning.

C. APPARATUS AND PROCEDURE

Twenty-four pigmented rats, selected at random from a colony maintained by the University of Alabama, were trained in acquisition and extinction of a simple running response. An apparatus of floor size and plan comparable, except where noted, to that employed by Wilcoxon, Hays, and Hull (16) was utilized. The *S*s were required to proceed from a start box through an 11-inch runway. At the end of the runway a door was encountered which, when raised by *S*, gave access to the goal box. The entire apparatus was illuminated at the appropriate stimulus intensity. All *S*s were run after 22-hour food deprivation. The apparatus was so arranged that depression of a switch by *E* would activate a solenoid mechanism resulting in simultaneous opening of the door of the start box and setting into operation a timing device. Elapsed time was recorded to a precision of .01 second. Raising of the door separating the runway from the starting box by *S* served to interrupt a photoelectric relay terminating operation of the timing mechanism. The training consisted of three phases.

1. *Preliminary Training*

A familiarization period of six days was provided for all *S*s. For a period of 20 seconds *S* was confined in the start box. During this period the appropriate intensity of illumination was provided throughout the entire apparatus. Upon expiration of the period of confinement the door of the start box was opened and *S* allowed to proceed into the illuminated alley way and goal box of the apparatus. Half of the *S*s were exposed to an illumination of 128 foot candles while the remainder were exposed to an illumination of 4 foot candles. Illumination was provided from overhead by diffusing the light provided by incandescent bulbs through tracing cloth and plate glass. The intensity of the illumination was determined by placing an exposure meter, especially designed to allow incident light determinations, upon the floor of each of the compartments. Excessive heat was removed from the boxes containing the light sources by a ventilating fan.

On the initial day of training the door separating the goal box from the runway was secured in the fully open position. On succeeding days it was lowered approximately one-fifth of the distance per day so that on the sixth day *S* was required to open the door from the completely closed position to gain access to the goal box. On each of the six days a container of moistened Purina Lab Chow was placed in the goal box. Access to the apparatus during this phase was limited to a daily period of 10 minutes.

2. *Acquisition of the Running Response*

Each *S* was confined in the start box for a period of 20 seconds, the door opened and *S* allowed to proceed down the runway to the goal box. If *S* failed to enter the goal box in 90 seconds, the trial was terminated and *S* removed from the apparatus. The trial was scored as requiring infinite time. If *S* entered the goal box within the time limit, the elapsed time was noted and constituted *S*'s score for the trial. Time in the goal box during this phase was limited to 65 seconds and the reward was a moistened pellet of Purina Lab Chow weighing approximately .4 gram. Five trials were given *S* on each of 15 successive days; a total of 75 trials. Individual trials were separated by approximately five minutes.

3. *Extinction Series*

Commencing on the sixteenth day of training, a five-day extinction series was given both groups of *S*s. All experimental conditions remained constant with the exception of elimination of the food reward.

D. Results

Means of the reciprocals of the response latencies for each *S* during the 20 days duration of the experiment were selected as the indices of performance for examination of stimulus intensity effects upon response strength. These data are summarized graphically in Figure 1. An analysis of variance was performed upon the acquisition data. An F calculated for the purposes of evaluating the difference between stimuli yielded a value of 7.12 which for one and 300 degrees of freedom has a probability of chance occurrence less than .01. We reject the hypothesis of no difference in response latency of the two experimental groups during acquisition of the running response.

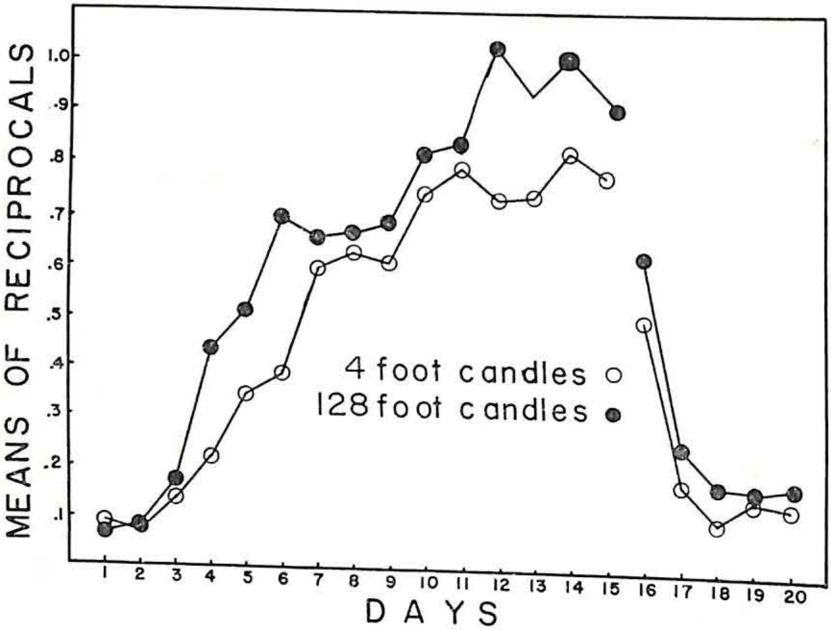

FIGURE 1
Means of Reciprocals of Response Latencies for Two Conditioned Stimulus Intensities During Acquisition (Days 1 Through 15) and Extinction (Days 16 Through 20) of a Simple Running Response

An analysis of variance for the extinction data yielded an *F* of 2.05 which for 1 and 100 degrees of freedom has a probability of chance occurrence greater than .05. The hypothesis of non-differential performance with regard to response latency during the extinction series is accepted.

Analysis of these data, using as an index the number of responses given for each series of five daily trials, yields for the data of asquisition an *F* of 29.19 which for 1 and 300 degrees of freedom has a probability of chance occurrence less than .001. A similar analysis for the extinction data gave an *F* of 19.23 which for 1 and 100 degrees of freedom has a probability of chance occurrence less than .001. For this index a significant effect is found for both learning and extinction.

E. Discussion

The latencies of responses occurring during the acquisition trials reveal the effect of conditioned stimulus intensity. In the presence of the stronger conditioned stimulus the *S*s respond more rapidly and also more frequently. This finding is in accord with the studies of Hays (8), Perkins (13), and Bragiel and Perkins (2). It is not in agreement with the work of Carter (3) and Grant and Schneider (4, 5). It should be noted that the responses used by the former investigators were instrumental responses as was the present response and that those employed by the latter group were responses elicited in the classical manner.

For the extinction series the hypothesis of non-differential performance in regard to response latency was accepted while that for number of responses occurring during the extinction series was not. Resistance to extinction as revealed by occurrence versus non-occurrence of the conditioned response would perhaps be the best measure of strength of conditioning, while response latency would seem to be the better indicator of response strength although the two are, of course, not independent.

Use of the occurrence of response as an index of performance yields skewed and peaked distributions which necessitate caution in the interpretation of the tests of significance based upon them. The values of *F* obtained are exceedingly large, however, and in this situation it would appear that the risk taken in rejecting the null hypothesis is not considerable.

The finding in our preliminary study of no effect for the 8, 16, 32, and 64 foot candle groups during acquisition, yet a marked difference in the acquisition curve for the 4 foot candle group may serve as an indicator of the complexity of the relationship. With reinforcement held constant there is evidence that the effect is not at all uniform throughout the range of stimulus intensity values. Pavlov (10) held that the conditioned stimulus and its response must be biologically of less importance to the organism than the unconditioned stimulus and its response if conditioning is to occur. Razran (14) pointed up this notion in his reference to "favorable ratios of excitation." It may well be that the study of the isolated effects of conditioned stimulus intensity apart from its relationship to unconditioned stimulus intensity is in part responsible for the discordant findings of some investigators. There may be no simple relationship and description of the stimulus intensity function for the conditioned stimulus may require simultaneous description of the intensity function for the unconditioned stimulus.

F. SUMMARY

1. Twenty-four pigmented rats were trained in acquisition of a simple running response. Half of the *S*s acquired the response in the presence of an illumination of four foot candles while the other *S*s acquired the response in the presence of an illumination of 128 foot candles. Following acquisition of the response, both groups of animals were given a series of unreinforced stimulus presentations.

2. When reciprocals of response latency were employed as indices, there was found to be a statistically significant difference in response latency for reinforced acquisition trials. The *S*s experiencing a stimulus intensity of 128 foot candles demonstrated shorter response latencies than did those experiencing a stimulus intensity of four foot candles. During the extinction the difference in performance between the two groups of *S*s was not significantly different.

3. When number of responses occurring during daily sessions for both acquisition and extinction were analyzed, a significant difference in favor of the group conditioned under the stronger stimulus was found. Limitations of this index were indicated.

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The Journal of Genetic Psychology, 1956, **89**, 35-49.

STUDIES OF ABNORMAL BEHAVIOR IN THE RAT: XXIV. POSITION HABITS, POSITION STEREOTYPES, AND ABORTIVE BEHAVIOR*

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A. INTRODUCTION

Maier (4) has previously reported that of animals which develop position responses in an insoluble problem situation (50 per cent random reward and punishment), 70.6 per cent of the animals were unable to give up the position response in favor of a discrimination habit when the latter response was made available to the animal. However, of animals trained to form a position habit (100 per cent reinforcement of the correct response), only 25.7 per cent were unable to abandon the position response in favor of the discrimination habit. Thus the number of animals that fixated the position response differed depending on how the position response was acquired. Analysis of the manner of jumping to the positive and negative cards in the discrimination problem revealed that although the animals continued to jump to their previously acquired position side, they nevertheless had learned which card punished and which did not. For example, when the correct card was placed on the position side, the animals tended to jump normally to it, but when the incorrect card was placed on the preferred side the animals tended to jump abortively[2] to it. It seemed that the animals were able to learn the new discrimination problem but were unable to give up the old position response.

The previously reported percentages of animals fixating the unadaptive position response when a correct discrimination response was available were based upon data obtained in three separate studies in which different experimenters participated, preferred and non-preferred position responses were used, and the discrimination habit to be learned was relatively simple.

Since the demonstration of a difference in the number of fixated position

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*Received in the Editorial Office on October 26, 1954.

[1] The experiment was aided by a grant from the Horace H. Rackham School of Graduate Studies of the University of Michigan.

[2] In abortive jumping, the rats strike the card with the side of the body, jump to the side of the card, jump above the card, or jump lightly and grasp the ledge below the card.

responses obtained as a result of training under conditions of reinforcement and frustration is highly important from a theoretical point of view, it seemed desirable to repeat the basic design of the experiment with a larger number of animals using the same experimenter throughout. Two facts must be verified: (*a*) two kinds of position responses can be distinguished by the way they resist change, and (*b*) the proportion of the two types of position responses is influenced by the method in which they are developed.

In order to establish a relationship between rigid responses and frustration as contrasted with modifiable responses and motivation it is necessary to exclude certain possible experimental artifacts. Thus differences in motivation, perception, and reinforcement expectations must be eliminated before a basic difference in the nature of the initial responses is demonstrated. Some of these have already been considered and evaluated (5, 7).

Wilcoxon has contended that the abortive behavior obtained might be assigned a causative rôle in the development of fixations (9). He feels that the abortive responses are adaptive solutions ". . . which tend to decrease whatever effectiveness punishment at the windows can have . . . and which make it quite unlikely that an animal which has learned an abortive jump will ever learn to perform the test problem" (9, p. 331). Essentially then, Wilcoxon is saying that animals with fixations have learned something other than what the experimenter intended them to learn and that what Maier calls abnormal fixation may merely be a strong habit that had not been recognized. Thus, there would be no learning of the correct discrimination since the differential consequences of the positive and negative card are either reduced or eliminated. If this is the case, then it would be expected that (*a*) there will be a significantly greater number of animals showing abortive behavior in the insoluble problem group than in the trained group when the groups are required to replace their position responses with a discrimination response; (*b*) the abortive behavior will be confined primarily to the animals in each group which fail to learn the discrimination response; and (*c*) there will be no differential manner of jumping to the positive and negative cards when they are placed on the side of the animal's position preference. If, however, abortive behavior is not causally related to the presence or absence of fixations, then it would be expected that abortive behavior will be shown both by animals with fixations and those without fixations. This latter expectation would be derived from Maier's theory which merely considers abortive behavior to be an animal's attempt to reduce the pain which it has learned it will receive whenever it jumps to the locked card. When the animal has a compulsion to jump to a particular position (e.g., left window) it can still learn which card punishes and which rewards, and this learning can be reflected in the manner of jumping although the compulsiveness of the fixated position response cannot be overcome.

The purposes of the present experiment, therefore, are (*a*) to verify the previously reported difference in the effect that reward and frustration have on the proportion of rats developing abnormal fixations, and (*b*) to test the relationship between abortive behavior and abnormal fixations.

B. PROCEDURE

1. *Training Methods*

a. Preliminary training for all animals. All animals were tamed and given preliminary training in jumping to the windows of a modified Lashley jumping apparatus. At first, the animals were merely fed on the feeding platform until they became familiar with the environment and approached the food readily. This preliminary handling period generally lasted 10 days.

At the conclusion of the adjustment period, training in jumping was begun. The jumping platform was moved up to the open windows of the jumping apparatus and the animals merely had to walk through the openings to reach the feeding platform behind the windows. On successive days, the jumping stand was moved farther and farther away from the windows until the animals were jumping from a distance of eight and one-half inches. When they were jumping readily to the open windows from this distance, the stimulus cards (consisting of a black circle on a white background and a white circle on a black background) were gradually introduced. For the first few trials, the cards covered only a portion of the windows, but on subsequent trials, more and more of each of the cards was exposed until they completely covered the windows. During this period the cards were unlatched and a light push would cause either one of them to fall over and allow the animal to reach the feeding platform.

In all phases of this preliminary training period, the animals received 10 trials per day. The stimulus cards were moved from side to side in a prearranged random order so that all animals experienced jumping to both cards and to both windows. Whenever an animal showed a preference for either of the sides or cards, it was guided with the hand and forced to jump to the alternate side or card.

b. Acquisition training of position response.

(1). *Group PH.* At the end of the preliminary training period, the animals in this group were required to learn a position habit. This was accomplished by always rewarding the animals for jumping to one of the sides (left or right) regardless of which card was in the window and always punishing them for a response to the other side. The side rewarded was the position jumped to on the first experimental trial in which both windows were unlocked. (This side probably corresponded with the initial preferences of the animals.) Thus, whenever the animals jumped to the correct side the card fell over and admitted them to the feeding station where they obtained food. The side opposite the initial preference was always locked after the first experimental trial. A jump to this side resulted in the animals bumping their noses against the card and falling into the net below the windows. This treatment constituted punishment for the incorrect response. All animals in this group received 16 days of training with 10 trials per day being given.

(2). *Group PS*. At the conclusion of the preliminary training, the animals in this group were confronted with an insoluble problem. This was a situation in which neither a position (left or right) nor a card was consistently correct. As a consequence, the animals received punishment on 50 per cent of their choices and reward on the other 50 per cent since there was no response that consistently permitted escape from punishment or access to food. Under these conditions the animals soon resisted jumping to the cards and had to be forced to respond. A jumping response was forced by tapping the animals' tails with a ruler at the rate of one or two taps per second. Under these conditions the animals can be made to jump to the cards again and very soon nearly all animals adopt a particular response which they consistently execute. In most instances this is a position response. In this experiment all of the rats developed position responses within three days. Sixteen days with 10 trials per day were allowed for the strengthening of the position responses. [Earlier research (6) has shown that 16 days in the insoluble problem is optimum for producing fixated behavior.] Maier (4) has designated position responses developed without the aid of consistent reinforcement as *position stereotypes* to distinguish them from the position responses formed in a reward situation.

c. Test for fixations—learning of a discrimination habit. At the conclusion of the 16-day period allowed for the development of the position responses, the animals of Groups PH and PS were required to give up their position responses for a discrimination response. In this phase of the experiment, the black card containing the white circle was made the positive stimulus for both groups of animals whereas the white card with the black circle was made negative.

As a result of this change in experimental procedure it will be observed that animals now will be punished for practicing their position responses whenever the negative card is placed on the side of the acquired position response. However, the animals will be rewarded each time the positive card is on this position side. Thus, practicing of the established position responses will lead to inconsistent effects (reward or punishment), but responses to the positive stimulus card will lead to a consistent effect-reward.

In introducing this change in procedure several types of sequences were followed. These sequences varied in the number of times that the positive and negative cards were placed on the side of a given animal's position response. In this manner it was possible to vary the frequency of reward and punishment of the established position response in a given set of 10 trials. Since these conditions were similarly used in Groups PH and PS, any differential effects produced by them need not concern us for the purposes of the present experiment.

Regardless of the sequence used all animals were permitted 200 trials (at the rate of 10 trials per day) to change from position to discrimination responses. Previous studies have shown 200 trials to be an adequate number of trials for a rat to adopt a new response if it is able to do so. Since all animals are not able to alter their initial responses, the two groups will be compared not only on the basis of the number of trials required by the learners to learn but also on the basis of the number of animals persisting in their position response and the number giving up the position response but not adopting a new response.

2. *Subjects*

A total of 104 animals was used in this study. Forty-nine of the animals were used in Group PH and 55 animals were used in Group PS. All animals were taken from the stock maintained in our colony and were between 120 and 180 days old at the beginning of the preliminary training period. The two groups were not run simultaneously, although there was considerable overlapping in the scheduling of the training in the two groups. Within each group, however, litters were split for the purpose of measuring any effects of the variation of reward-punishment ratios.

3. *Results*

a. The acquisition of the position responses. The results for the development of the position responses are given in Table 1. It will be seen from this table that of the 49 animals in Group PH, 30 animals selected left position responses and 19 selected right position responses. Of the 55 animals in Group PS, 31 animals adopted left-going responses and 24 adopted right-going responses. Since the differences between the numbers of animals going to either the right or left in each of the two groups is not significant, it is apparent that the differences in the training procedures for the two groups did not determine the right or left direction of the position response. Rather, it appears that a natural preference of the animals is the determining factor. This difference in natural preference is also suggested by the fact that in both groups the responses that were adopted were selected quite early in the training and thereafter consistently executed. Thus, the animals in Group PH practiced their position responses for an average of 159.4 trials out of the 160 trials, or 99.6 per cent of the time, while the animals of Group PS practiced their position responses an average of 152.5 trials out of the 160 trials or 95.3 per cent of the time. The fact that the animals in Group PH practiced their position responses slightly more often than the animals in Group PS places the influence of frequency of repetition on response strength in the same group as the frequency of reinforcement, i.e., Group PH.

TABLE 1

DEVELOPMENT OF POSITION RESPONSES

	No. of animals	No. adopting left position	No. adopting right position	Av. No. of trials response practiced	Per cent of total trials
Group PH	49	30	19	159.4	99.6
Group PS	55	31	24	152.5	95.3

b. The measurement of fixations produced by the two training methods. Table 2 presents the data obtained when an attempt was made to change both sets of position responses to discrimination responses. The second line of the table shows the number of animals in Groups PH and PS that fixated the position response and the third line shows the number that were able to abandon their position responses in the 200 trials allowed for substituting a discrimination response. It can be seen that 25 out of the 49 animals in Group PH (51.0 per cent) were able to abandon their position responses, whereas only 4 out of the 55 animals in Group PS (7.3 per cent) were able to abandon their position responses. This difference between the two groups yields a corrected Chi-square of 22.5 which is significant at well below the .001 level. Thus it appears that the position responses produced in Group PH are clearly less resistant to change under the conditions tested than are the position responses produced in Group PS.

The fourth line of Table 2 shows the proportions of animals in the two groups that were able to learn the new discrimination response in addition to abandoning the old position response. It will be seen that 17 out of 49 animals of Group PH (34.7 per cent) learned, whereas, only 3 out of 55 animals in Group PS (5.4 per cent) learned. The difference yields a corrected Chi-square of 12.47 which also is significant at well below the .001 level. Thus most animals which succeed in giving up the old response are able to learn the new one. However, giving up the old response is not identical with replacing it with another learned one.

TABLE 2

MODIFICATION OF POSITION HABITS AND POSITION STEREOTYPES

	Group PH	Group PS
No. of animals	49	55
No. of animals with position fixations	24 (49.0%)	51 (92.7%)
No. of animals abandoning position response	25 (51.0%)	4 (7.3%)
No. of animals learning discrimination habit	17 (34.7%)	3 (5.4%)
Av. no. of trials to abandon position response	57.8*	62.7†
Av. no. of trials to learn discrimination habit	104.1‡¶	83.3§¶

*Range, 4-133.
†Range, 50-69.
‡Range, 30-150.
§Range, 60-120.
¶Criterion trials not counted.

It might be supposed that the differences in the number of successful learners obtained in the two groups is due, in some manner, to the fact that the learning problem is made more difficult for one group than for the other. If this is true it follows that the rate of learning for the successful animals in the two groups should differ also. The last two lines of Table 2 give the learning scores in terms of trials to abandon the old responses and in terms of the total number of trials to adopt the new response. For Group PH the scores for these two measures are 57.8 and 104.1 respectively and for Group PS the corresponding scores are 62.7 and 83.3. The scores clearly indicate that the learning problem for the learners is strikingly similar in the two groups.

It should also be noted that the 200 trials permitted for abandoning the old response are more than adequate. This is shown by the fact that the ranges in scores of the successful animals in both groups is well below the limit set, and that the animals of Group PS which abandoned fell entirely within the range of the "abandoners" in Group PH. As previously found, there is a wide difference between successes and failures which cannot be attributed to variations in ability. The groups primarily differ in the proportion of successes and failures.

Let us now explore Wilcoxon's idea and see whether failure to learn can be attributed to abortive behavior which so reduces the effect of punishment that the animal no longer needs to learn. Inspection of Table 3 shows that abortive behavior appeared in both Groups PH and PS, and that its appearance seems not to depend on whether or not the animals within these groups fixated. If we disregard for the moment those animals which fixated and those which did not fixate, and merely consider Groups PH and PS, we find that 32 out of 49 animals (65.1 per cent) in Group PH showed abortive behavior, and 40 out of 55 animals (73.2 per cent) in Group PS showed this behavior during the discrimination training period. This difference yields a Chi-square of 0.670 which is significant at approximately the .40 level. It is apparent therefore that this difference cannot be considered to be the basis of the difference in the number of fixations obtained between Groups PH and PS.

TABLE 3

ABORTIVE BEHAVIOR AND ITS RELATION TO FIXATION

	Group PH		Group PS	
	Rats with fixations	Rats without fixations	Rats with fixations	Rats without fixations
No. of rats	24	25	51	4
No. of rats showing abortive behavior	17	15	38	2
No. of rats showing differential abortive behavior	15	14	38	2
Av. day differential abortive behavior shown to criterion of three successive days	7.1	6.5	6.4	3.0

Turning next to the animals with and without fixations within each of the two groups we also fail to find support for Wilcoxon's hypothesis. Of the animals in Group PH which fixated, we find that 17 out of 24 (70.8 per cent) showed abortive behavior, whereas 15 out of the 25 animals (60.0 per cent) without fixations showed abortive behavior. A Chi-square test of this difference yields a value of 0.246, corrected for continuity, which is significant at about the .60 level. In Group PS, 38 out of the 51 animals with fixations (74.5 per cent) showed abortive behavior, while two out of the four non-fixating animals (50.0 per cent) showed abortive behavior.

This difference yields a Chi-square corrected for continuity of 0.227 which is significant at approximately the .60 level. Thus none of the three tests of Wilcoxon's hypothesis approaches an acceptable measure of significance but the scores are in the right direction.

If we conclude that abortive behavior plays no causative rôle in the appearance of fixations, why is the trend in each instance in the direction predicted by Wilcoxon's hypothesis? We feel there is a simple explanation for this. Animals that are unable to learn the new response are in the punishing situation longer than learners and hence more of them should eventually find ways to reduce punishment.

Of special interest is the fact that practically all animals which jump abortively do so more frequently in connection with the negative than with the positive card (i.e., when negative and positive cards are on the side of the position response). This differential abortive jumping becomes another measure of learning the discrimination problem; however it is an expression of learning which is not in conflict with the position response.

The third line of Table 3 shows the number of fixated and non-fixated rats showing differential abortive jumping in the two groups.

In Group PH, 15 out of the 24 animals (62.5 per cent) which fixated the position response showed a differential manner of jumping, while 14 out of the 25 (56.6 per cent) non-fixating animals showed a differential abortive response. In Group PS, 38 out of 51 animals (74.5 per cent) with position fixations showed a differential abortive response, while two out of the four non-fixating animals (50.0 per cent) showed differential abortive behavior. It is clear therefore that most of the animals were able to learn which card punishes and which card rewards (as reflected by the consistent differential manner of jumping to the two cards when they were on the position side). Furthermore, no significant differences were obtained between the fixating and non-fixating animals in either of the two groups. These facts not only make Wilcoxon's views untenable but also further exclude the possibility that the difference between the groups can be reduced to some difference in learning ability.

Finally, we may consider as a measure of learning the day on which the differential abortive behavior appeared. A criterion of a greater number of abortive responses to the negative than to the positive card on three successive days was used. The last line of Table 3 shows that for the animals in Group PH with position fixations differential abortive behavior appeared in an average of 7.1 days, whereas for the animals in this group without fixations differential abortive behavior appeared in an average of

6.5 days. For the animals in Group PS with fixations differential abortive behavior appeared in an average of 6.4 days, and for the animals in this group without fixations this behavior appeared in an average of 3.0 days.

This last score is based upon two cases and has little meaning. However the other three measures of learning are based upon 14 or more cases and they show a striking similarity. Needless to say no significant differences were obtained.

The data do not support any view which suggests that animals in Groups PH and PS differ in their ability to abandon a position response because of a difference in the difficulty of the discrimination problem as presented to the two groups, or because of any difference in their behavior (abortive) when they enter the stage of training that requires a change.

Failure to find explanations of this sort further strengthens the view that some difference in the nature of the initial position response must be the cause of the difference between Groups PH and PS. The view that a state of frustration, when created in an animal, causes certain highly available behaviors to become fixated is supported.

C. Discussion

The number of fixations obtained in this study was 49.0 per cent in the position habit group (rewarded) and 92.7 per cent in the position stereotype group. Although it has been shown that position responses corresponding to the natural preference are easier to break than those that are opposite to it this number of position fixations is somewhat higher than the number previously obtained. As indicated in the introduction the combined previous studies yielded 25.7 per cent fixations for position responses and 70.6 per cent fixations for position stereotypes. Our present figures therefore are 23.3 per cent greater for position habits and 22.1 per cent greater for position stereotypes.

The most logical explanation for this increase is the fact that the discrimination problem used in this study was made more difficult than formerly. In previous studies the white card with the black circle was the positive stimulus and in this study the black card with a white circle was the positive stimulus of the pair. Maier (3) previously showed that rats required 83.6 trials to learn to discriminate between a white circle on a black card and a black circle on a white card when the black circle is the positive stimulus but that they required 145.6 trials when the white circle was the positive stimulus. Thus the greater difficulty of the discrimination problem could account for the greater number of animals persisting in the position response.

However, the possible influence of the experimenter should not be overlooked. This seems especially worthy of mention because one of our graduate students who utilized similar procedures in another study was unable to obtain fixations and at the same time found the task of frustrating the animals unpleasant.

Wilcoxon's study (9) from another laboratory permits a comparison of the number of fixations that are obtained in a partial repeat of our experiments in his laboratory. Two of his groups corresponded to ours. His Group I (continuous reinforcement) is like our position habit group and he obtained 38 per cent fixations, a result about half way between the figures given above. His Group III (insoluble problem) is like our position stereotype groups and in this group he obtained 58.0 per cent fixations, a figure which is somewhat lower than our figures, but nevertheless approaches our earlier studies in which the same member of the discrimination pair was made positive. It seems then that the appearance of fixations is not dependent upon the theoretical biases of the experimenter. Nevertheless the possibility that his behavior may detract from or add to the frustrating conditions should not be overlooked.

Although Wilcoxon points out that the difference he obtained between his Groups I and III is not significant it should also be recognized that he used only 12 or 13 rats in his groups. Data obtained from groups of this magnitude frequently yield differences that are not statistically significant. Certainly one would not wish to claim that no difference between the groups has been demonstrated.

Of further interest is the fact that in Wilcoxon's Group II (partial reinforcement) 92.0 per cent of the animals had fixations. In this group he produced position responses by punishing animals on only half of the jumps to a particular position and punishing them 100 per cent of the time for jumps to the opposite position. Thus even though this problem is soluble, the animals still receive punishment on half of their trials if they consistently jump to the correct side. Although this may be called partial reinforcement, it is clear that to rats unfamiliar with the experimenter's intention, this condition would initially give punishment on 75 per cent of the trials and reward on 25 per cent. In fact Wilcoxon mentions the fact that these animals received more punishment before a consistent position response was adopted than the animals in Groups I and III. We would consider this the most frustrating condition and hence the most conducive to the production of fixations.

Wilcoxon points out that all of the difference he obtained could be "easily accounted for by conventional S-R learning theory" (9, p. 328), however, he has yet to explain why he got fixations in *any* of his groups. Apparently he too obtained bimodal distributions in the sense that some animals showed no evidence of learning the simple discrimination problem even though the positive card systematically offered reinforcement.

We also were unable to support Wilcoxon's suggested hypothesis that abortive behavior interferes with the learning of the discrimination response. He obtained a greater number of abortive jumps from non-learners than from learners during the acquisition of the position response and he pointed out that the abortive responses may have interfered with learning. It is also possible to postulate that failure to learn made the need for abortive responses greater. To differentiate between these two interpretations it is only necessary to examine the development of abortive behavior. Our data reveal that both learners and non-learners show abortive behavior to a similar degree at the beginning of the discrimination problem. Soon most of these animals show abortive responses more often when jumping to the negative than when jumping to the positive card. This reveals that the animals are making a discrimination between the positive and negative cards. Again we found learners and non-learners strikingly similar at this stage. Following this stage of differential abortive behavior some animals master the problem and thereafter jump to the positive card, regardless of the side on which it appears. These are the learners. Other animals fail to give up their position responses and instead continue to jump abortively.

Wilcoxon finds support for his hypothesis when he combines all the learners of his three groups and compares them with the non-learners from the three groups with respect to the frequency of abortive jumping during the acquisition period of the position response. However, when he does this, he is ignoring the fact that most of his non-learners came from his most frequently punished groups (Groups II and III). Certainly, abortive behavior, number of non-learners, and frequency of punishment are related. However, the nature of the relationship may vary. Wilcoxon assumed that one kind of relationship holds, namely, that frequency of abortive behavior decreases the frequency of learners. However, several other relationships are possible for these three variables; in fact, even the opposite relationship—that failure to learn increases the frequency of abortive behavior. We feel that our analysis of abortive behavior is more discriminating than Wilcoxon's since the hypotheses derived from his point of view were not experimentally supported.

Analysis of the discrimination problem faced by animals with position habits and by animals with position stereotypes yielded no clues as to why more of one group learned than of the other. As a matter of fact, the performance records of the animals in Groups PH and PS which learned are strikingly similar. The non-learners in both groups likewise show similar performance measures. The distinguishing feature was the difference in the proportion of learners and non-learners within the two groups. In order to account for the above results it has been necessary to develop the following three postulates:

(*a*). The number of fixations produced depends on the number of animals frustrated.

(*b*). Animals differ in their frustration thresholds.

(*c*). The number of animals frustrated varies depending upon the degree to which a situation introduces barriers, obstacles, punishments, etc.

Further research needs to be done to determine and measure conditions which lead to frustration and which cause differences in frustration thresholds. However, the difference between our two training situations is sufficiently great that it is reasonable to conclude that the insoluble problem situation is more conducive to frustration than the position habit learning situation.

The experimental evidence further supports the previously expressed view (4) that responses developed during frustration are different in kind from those developed under conditions of motivation. In addition, the evidence suggests directions in which future research might profitably proceed toward the clarification of the mechanisms underlying abnormal fixations.

D. SUMMARY

A total of 49 rats (Group PH) were trained to form position responses and then were required to replace this response with a discrimination response. Another group (Group PS) of 55 rats was placed in an insoluble problem (exposed to a frustrating situation) and they too developed position responses as their way of responding to the situation. This group like the other was then required to learn the discrimination problem.

The major results obtained are as follows:

1. Forty-nine per cent of the rats with positions habits (reward produced) persisted in their position responses and failed to learn and adopt the discrimination response; whereas, 92.7 per cent of the rats with position stereotypes (produced in an insoluble problem) failed to give up their position responses.

2. Animals in both groups that succeeded in giving up the position response, showed strikingly similar learning scores.
3. Most animals which failed to adopt the discrimination response by jumping to the positive card nevertheless showed that they had made a discrimination by jumping abortively more frequently to the negative than to the positive card. (Abortive jumps are ineffective as revealed by the fact that the animal will not reach food even if the card is unlocked.)
4. The development of differential abortive behavior can be used as a lenient criterion of learning and its appearance precedes the behavior of jumping to the positive card in the discriminating problem.
5. All animals showing differential abortive behavior do not eventually follow the positive card. However, the appearance and nature of differential abortive behavior in these "failures" is the same as that of the "successes."

It is concluded that (*a*) position responses developed during frustration persist even though they are unadaptive, and (*b*) abortive behavior is an animal's way of reducing the punishment of jumping to a locked window.[3]

Such position responses or abnormal fixations are consistent with the view that behavior developed during frustration is different in kind from analogous behavior developed under motivated learning conditions. The abnormal fixation has a compulsive character so that the animal must jump to a particular place. However, this compulsion does not prevent the acquisition of adaptive (pain reducing) responses which are not in conflict with it. Thus the *behavior* developed under frustration may be unadaptive and without a goal. The rat still can entertain needs but it can only satisfy them to the extent that they do not interfere with the compulsion.

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[3] Many critics [e.g., Dollard and Miller (1), Farber (2), Mowrer (8), and Wilcoxon (9)], have indicated that these points are untested observations which can be interpreted differently. It should be noted that they are here stated as experimental conclusions and at no time have we considered either of these points to be direct observations. Our behavior data are given in tables and various relationships have been demonstrated. It is these experimental measures that must be given another explanation if the above conclusions are to be logically rejected. To point out that jumping to the incorrect window gives the animal an escape from the air blast, a reduction in tension, or some kind of partial reinforcement assumes the above to be the experimental facts rather than conclusions. An *explanation* of a set of facts and *facts* requiring an explanation are always differentiated in scientific theory.

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THE DRAW-A-GROUP TEST*

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A. Introduction

The use of human figure drawings for the study of personality is extended in the present exploratory study to the drawing of a group to reveal the structure of the group and the individual's adjustment to it. The Draw-A-Group Test is designed to identify the status of the individuals in the group from leaders through followers to isolates. The problem of this research is to demonstrate that the children in any one group can be ranked in a hierarchy of leaders, followers, and isolates on the basis of their drawings of the group.

The fact that children usually enjoy drawing has led many investigators to utilize children's art productions as an indication of the child's personality development and his adjustment to the demands of society about him. The earliest systematic work in this area was done by Goodenough (1926) who developed the Draw-A-Man Test as an intelligence test. It soon became apparent to clinicians using the Goodenough test that children with the same *IQ* on the Goodenough scale were revealing very different things through the drawing of the human figure.

This has led such clinicians as Machover (1949) and Buck (1948) to develop drawing tests as projective instruments for use with both adults and children. These tests depend on content analysis and the associations and symbols derived from the human figure. Other approaches to children's drawings emphasize the importance of color (Alschuler and Hattwick, 1947) and the analysis of formal elements (Elkisch, 1945). The various criteria for drawing analysis are summarized in Bell (1948) and Precker (1950).

There have been suggestions in the literature that a drawing of the group might reveal useful information. Wolff (1946) points out that the child's drawing of his family might reveal important information about his relationships in this area, and Hulse (1952) has in fact studied childhood conflict through family drawings. Levy (1950) has used a figure drawing technique in which the male subject is asked to draw two men and one

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*Received in the Editorial Office on November 2, 1954.

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woman, the female to draw two women and one man which sets up a triangular situation that may recall a sibling theme or oedipal dynamics. However, the particular problem of having the individual draw his peer group has not been reported in the literature although it would seem that such a method as the Draw-A-Group Test would have the advantage of revealing the subject's adjustment to the group as well as providing information for clinical analysis similar to that of the individual figure drawing tests.

B. Method

The sample for the study consists of 10 classes of children, five from the first, second, and third grades in two private day schools and five from two public schools in New England. The classes range from eight to 24 members giving a total *N* of 166. The children are from the middle and upper socio-economic levels and include several with recognized emotional problems and physical handicaps. The ages range from six to 10 years.

The test is administered in the classroom. The drawings are done with colored crayons on 18″ x 24″ paper. The instructions are as follows:

> Think of the children you like to play with most on the playground. Now think of the thing you like to do best with this group of children. Then draw a picture of your group doing the thing you like to do best. When you are through we will write down what is going on in your picture.[2]

As the children finish, information about their pictures is recorded by the experimenter including the names of the children in the picture (in the order drawn) and what is happening as told by the child.

The teacher is asked to place the children in her class in rank order from the best leader to the most isolated and briefly describe why each position is given each child.

After obtaining the above information the original drawings are analyzed by the experimenters and placed in a rank order which is then compared with the teacher's independent ranking.

The criteria for analyzing the drawings are the result of suggestions in the literature such as a range of colors used, use of dark or somber colors, use of space and relative size of figures, hostile or threatening aspects of figures, unusual characteristics of figures such as distortions or omissions, and bizarre or unusual objects. Additional criteria are used which seem meaningful relative to the nature of the instructions and of group activity in general. These are the number of figures in the drawing, the nature of the activity, the centrality of the subject in the activity, the inclusion of children from other classes, the inclusion of authority figures such as the teacher, partial drawings on the back or evidences of resistance to the task, and the general appropriateness of the drawing and the child's description of the activity to the instructions.

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[2] In five of the classes the child is specifically asked to include himself in the picture.

Four drawings are reproduced to illustrate the application of the criteria in ranking the pictures and to contrast productions of leaders and isolates.[3] The drawings of Judy and Donald, two children ranked as leaders, are contrasted with the drawings of Johnny and Robert, two isolates.

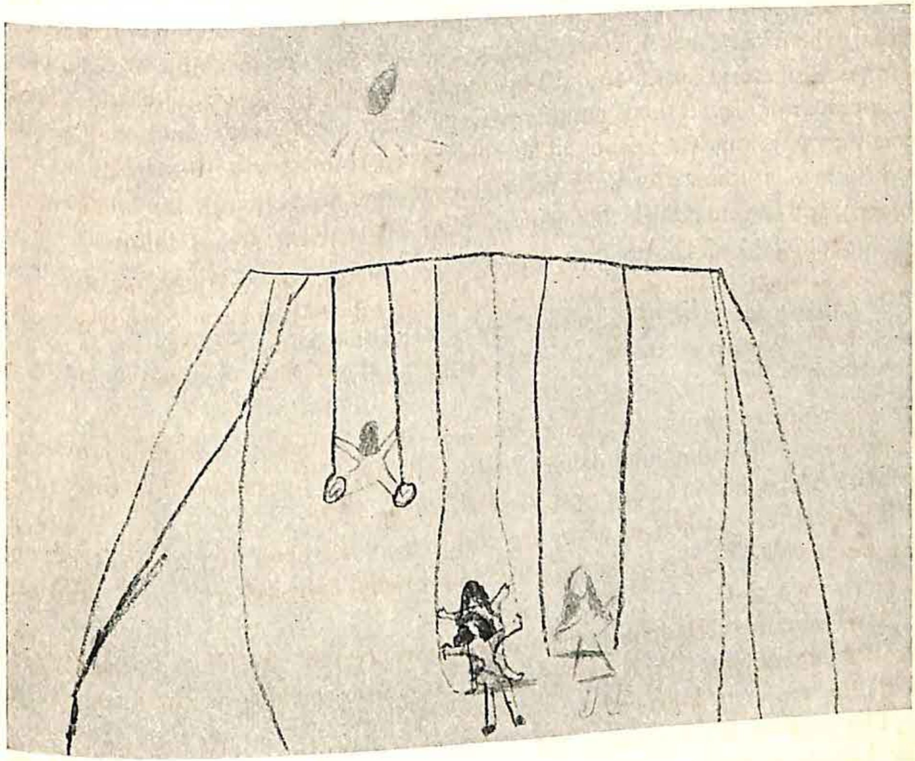

FIGURE 1

Judy is a girl in the first grade in a private school. Her drawing (Figure 1) shows herself seated on a swing with another girl above her on the same swing. A third girl is on the swing to her right and a fourth above on the left on the rings. There is a suggestion of sky and a small sun. The story she tells about her drawing is:

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[3] For purposes of reproduction the authors have altered the drawings of Judy and Robert by darkening the yellows.

> Ann and I are going double decker. Mary is on the other swing. Betsy is playing most dangerous girl in the world—she likes to do that.

Judy's drawing is ranked first in her class by the authors. She includes several figures, she recognizes different relationships and draws herself centrally and in intimate contact with Ann without being threatened by it. She perceives Betsy as less central and explains Betsy's behavior. Her drawing fills the page and she uses an adequate range of colors, tending toward the cool colors. Her figures show no distortions or bizarre elements. Judy's teacher ranked her second in leadership in the class and said this about her: "She is the best adjusted in the group and the youngest. All choose her if there is a question of choosing."

Donald is in the third grade in a public school in which his drawing (Figure 2) is ranked second by the authors. He shows a dodge ball game in which he is in the center and higher than the other boy who is in the center with him. Behind him to the left of the paper is a girl in his class and at the top of the page a boy from his class. The other three boys

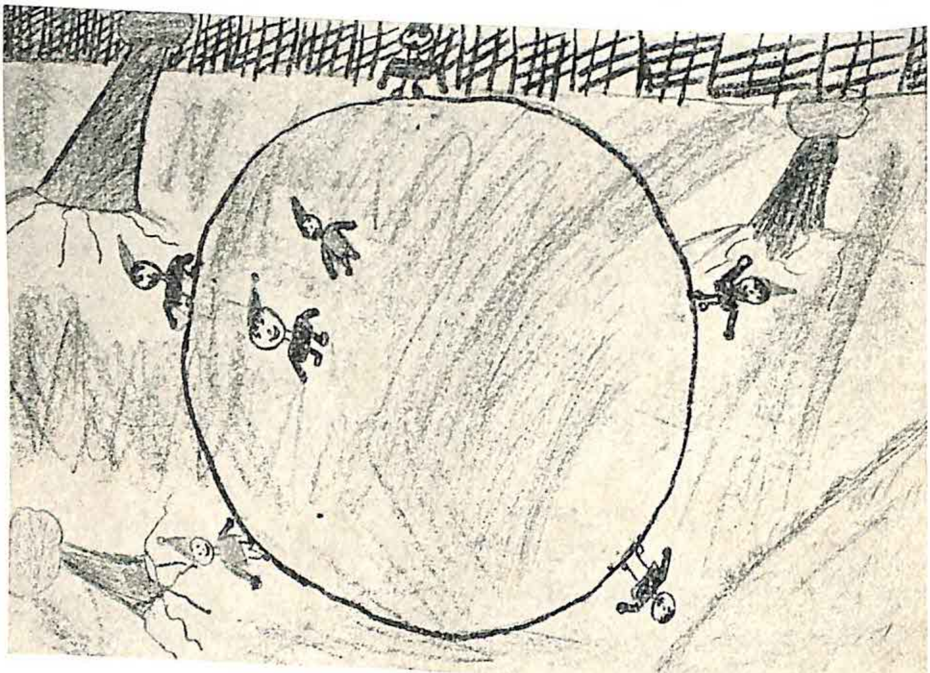

FIGURE 2

around the circle are from the other third grade. All the children are identified by name. He uses a range of colors, shows himself in a central position, although smaller than the boy with him. He includes other objects such as trees and fence but they do not dominate the picture as in some children's drawings. In describing his drawing he says, "We are playing dodgeball." Such a game indicates some level of organization and numerous relationships. Donald includes three out-of-class choices in his picture, a factor which would usually indicate a less central position in his own class. However, in this case the children are from another third grade which shares the same recess period and the two classes customarily play together. His figures show no omissions, but the hats are rather unusual. It was learned subsequently that Donald always wears a stocking cap. His teacher ranks him third in leadership and describes him as a dominating leader and a close associate of the child he pictures in the center with himself.

Johnny is in the second grade of the combined second and third grade in a private school. His drawing of himself on the swing (Figure 3) is ranked lowest in his class. He includes no other figures in his drawing. He uses only one color, brown, and his drawing is limited to only one quadrant of the paper. He emphasizes his eyes and hair which gives his

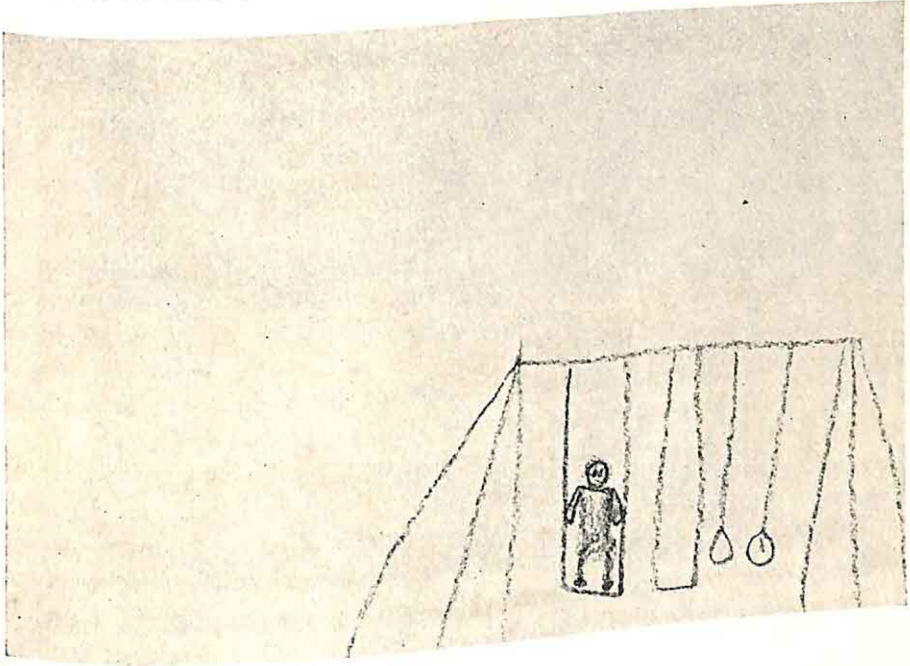

FIGURE 3

face an unusual expression and omits his hands. In telling about his drawing he says, "I'm swinging. I don't like anyone else. I always feel sad." This seems quite direct and revealing. His teacher also ranks him as the most isolated in the class.

Robert is in the third grade in another private school. The shaded object to the left of his paper (Figure 4) is a tree. The next object is a boy he usually plays with but he's forgotten his name, "maybe Archie." The figure to the right of the drawing standing on the shaded area is an Indian: "I'm him." The figure above him with facial characteristics which does not touch the ground is a fairy. There is also a large sun. Robert's drawing is illustrative of the bizarre elements which some children include in their drawings. It indicates sufficient disturbance to be ranked lowest in the class by the experimenters. His drawing uses mostly green and is largely a line drawing. In explaining it he says: "That person (identified as a fairy) is flying away. It's supposed to be some sort of animal. They

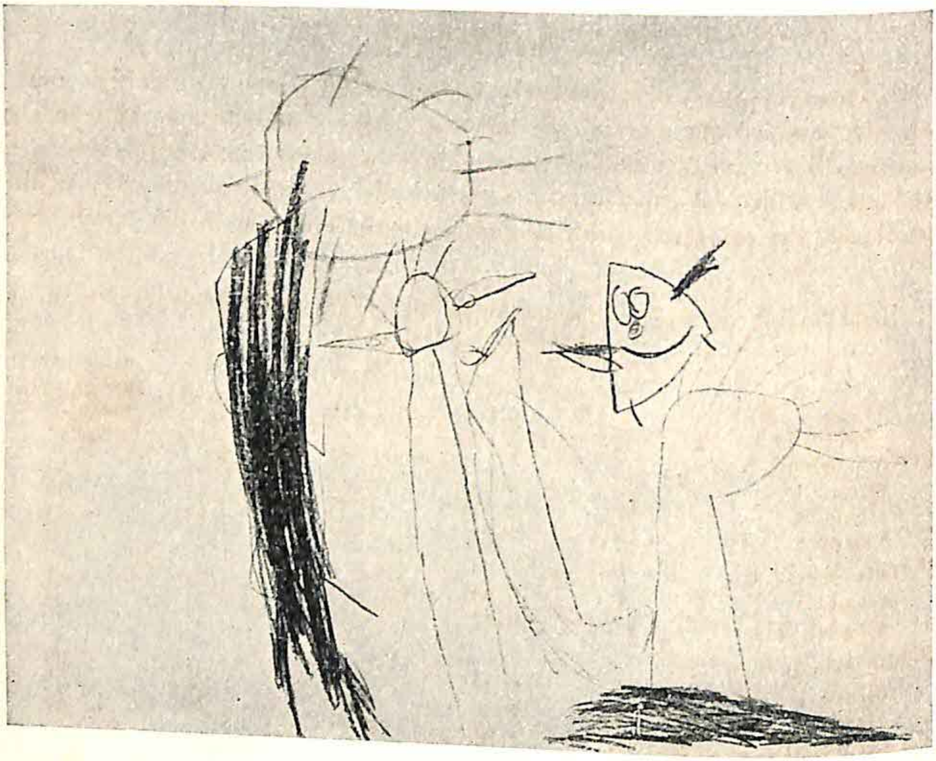

FIGURE 4

are planning to cut that tree down. That's a long word. That (identified as Indian-self) is doing nothing, only I put it there for fun." As can be seen the story is not exactly congruent with the picture, and both are divorced from the playground situation and from reality. Robert also has some lines drawn on the back of his paper which he describes as a tree. His teacher ranks him as most isolated in the class and her comments are: "Just out of it, in a world of his own—so different."

C. RESULTS

Positive correlations between the picture ranking and the teacher's ranking are obtained for nine of the 10 classes with a mean[4] of +.52 which is statistically significant[5] since the probability of a mean correlation this high or higher if the true correlation is zero is <.01. In addition, for seven of the 10 classes the correlations are statistically significant and in the eighth class the correlation approaches significance ($p < .06$) (Table 1). This evidence supports the hypothesis that a child's drawing of his group is related to his position in the group.

TABLE 1

CORRELATION OF DRAWING RANK WITH TEACHER'S RATING FROM LEADER TO ISOLATE IN EACH CLASS

Class	n	r'	Prob. of r'	r' for extremes	Prob. of r' for extremes
Private School A					
Grade 1	17	+.53	<.02	+.65	<.01
Grade 2	15	+.18	>.27	+.38	>.15
Grade 3	14	+.82	<.01	+.92	<.01
Private School B					
Grade 1	8	+.64	<.05	+.71	<.01
Grades 2, 3	12	+.80	<.01	+.76	<.02
Public School C					
Grade 2	24	+.33	<.06	+.53	<.02
Grade 3G	20	+.46	<.02	+.63	<.01
Grade 3H	20	+.41	<.04	+.47	<.05
Public School D					
Grade 2G	19	—.04	>.46	—.23	>.25
Grade 2H	17	+.66	<.01	+.76	<.01

After ranking some of the drawings it appeared that it was easier to rank the drawings at either extreme of the distribution in any one class. To test this hypothesis rank correlations are also computed for a collapsed ranking consisting of only the upper and lower thirds for each class. This operation increases the mean correlation to +.62. The difference between this mean correlation and the mean correlation for the entire ranking is significant (prob. $<.05$).

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[4] The z transformation is used in computing the mean and in the test of significance for the mean since the variance of the Spearman rank correlation (r') is approximately that of r. (Kendall 1948, p. 111.)

[5] The .05 level of significance for a one tail test is used.

D. Discussion

In developing any new method there is always the problem of validating it against existing indices such as relating it to observations of behavior. Since this approach is beyond the scope of the present research, teacher's observations are used as a first approximation although the teacher tends to perceive the child primarily in the rôle of learner rather than group member.

Differences are observable between the drawings of public and private school children and between classes in the public school which should be recognized in normative studies. There are more disturbed drawings produced by private school children as might be expected since these are often the children who are unable to conform to the demands of the public school and so are withdrawn and placed in private schools. The drawings of the public school classes show less variability than those of the private schools due to the fact that drawing standards are set by the public school teacher whereas the child in the private school is left relatively free. For this reason the public school children use a wider range of colors, their figures are more uniform, and all are taught to fill the space and shade in the background of the page leaving no white space. More variability is obtained which aids in ranking the pictures when large size paper, 18″ x 24″, is used rather than a smaller size.

The instructions can be modified depending on the type of group and the information desired. The instructions given above are for the playground since this is essentially a peer group oriented situation and not structured by the teacher or curriculum. Drawings obtained for the classroom situation in several classes show less interaction between children and reveal much less of the group structure.

E. Summary and Conclusions

As an extension of the use of human figure drawings for the study of the personality and adjustment of children the Draw-A-Group Test is designed to differentiate the status of the individuals in a group from leaders through followers to isolates. In an exploratory study 166 first, second, and third grade children in 10 classes are given the test. The subjects use crayons and 18″ x 24″ paper to draw a picture of the group they like to play with best on the playground doing the thing they like to do best. The names of the children in the order in which they are drawn and the story are recorded.

When the teacher's ranking of the class from leaders to isolates is compared with the authors' ranking based on the pictures, a significant average rank correlation of +.52 is obtained for the 10 classes. When only the extremes of each class ranking are considered the average rank correlation is +.62, an increase which is significant. The results thus support the hypothesis that a child's drawing of his group is related to his position in the group.

Differences observed between drawings of public and private school children suggest only one of the dimensions which will be explored in normative studies before the Draw-A-Group Test can be used with confidence in a variety of settings.

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The Journal of Genetic Psychology, 1956, **89**, 61-64.

ACQUISITION OF SUCCESSIVE AND SIMULTANEOUS DISCRIMINATION HABITS BY CATS*

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A. INTRODUCTION

The two experiments reported in this paper were designed to determine the relative difficulty of simultaneous and successive discrimination problems for the cat.

Both Spence (3) and Bitterman and Wodinsky (1) have found that, when rats are required to approach the discriminanda, simultaneous discrimination problems are learned more rapidly than successive discriminations. The present investigations were undertaken to test the generality of the results obtained with rats by studying the learning of another species, under dissimilar motivational and training conditions.

B. METHOD

1. *Subjects*

A total of 20 *S*s was used in the two experiments. All were young and experimentally naïve housecats, and they had been thoroughly adapted to the experimental situation before discrimination training was begun.

Water and Purina lab chow were available to the *S*s at all times in their living quarters, since previous observations indicated cats' learning is disrupted by intense hunger. Adequate motivation was assured by using kidney and liver, both highly preferred foods, as reinforcing agents during training.

2. *Apparatus*

The Wisconsin General Test Apparatus (2, Figure 1) was used throughout both experiments. The only modification from the published description of the apparatus was extension of the test tray to fit flush against the restraining cage, so that the cats could easily draw bits of meat into the cage.

The stimulus objects were four double pairs of wooden blocks randomly selected from a large collection of objects. The members of each pair differed

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*Received in the Editorial Office on November 2, 1954.

[1] This research was supported in part by research grant M-835 from the National Institute of Mental Health of the National Institutes of Health, U. S. Public Health Service.

in four visual dimensions: form, brightness, thickness, and surface area. Each problem presented a unique combination of differences in these dimensions.

3. *Procedure*

The standard procedure for setting individual test trials in the *WGTA* (2) was followed in these experiments. Two dissimilar (*A* and *B*) objects were presented on every trial of the simultaneous problems; the cat was rewarded with a piece of meat for choosing (i.e., displacing with its paw) the arbitrarily designated correct stimulus regardless of spatial position. Failure to secure food was the only punishment for choice of the incorrect block.

In the successive discrimination problems two identical objects were presented on any particular trial, but dissimilar blocks appeared on successive trials. The animal's task was to select the block on the left (or right) when confronted with two *A* blocks, and to select the object on the opposite side when two *B* objects were presented.

The position of the rewarded stimulus in the simultaneous problems, and the sequence of presentation of the *A* and *B* pairs in the successive problems, was varied from trial to trial according to a balanced, irregular sequence.

In both experiments, the *S*s were trained on four discrimination problems to a criterion of 20 out of 25 correct responses. Fifty non-correction trials were given per day until the criteria were attained.

4. *Experimental Design*

a. Experiment I. Eight cats were trained on both simultaneous and successive problems. Half the cats were tested in the sequence: simultaneous-successive-successive-simultaneous, the familiar *ABBA* order. The remaining four cats were tested in the reverse *BAAB* order.

b. Experiment II. One group of four cats were trained on four simultaneous discrimination problems while another group of eight animals were trained on four successive problems.

C. RESULTS

1. *Experiment I*

The mean number of errors to criterion on the simultaneous problems was 35; the average for the successive problems was 129 errors to criterion.

The value Wilcoxon's T obtained ($T = 53$) for paired replicates indicates that the difference is significant at the 1 per cent level of confidence. The largest number of errors made in learning on a simultaneous problem was 95. The maximum number of errors committed in mastering a successive problem was 559.

2. *Experiment II*

The cats trained on four simultaneous problems averaged 33 errors to the criterion of mastery. The mean for the cats tested on the successive discriminations was 97 errors to criterion. The magnitude of the Mann-Whitney statistic (U = 0) indicates that his difference is significant at the 0.2 level of confidence.

D. DISCUSSION

The results of the present experiment confirm and extend the findings previously reported by Spence (3) and by Bitterman and Wodinsky (1). Successive discrimination problems were once again found to be more difficult than simultaneous problems in spite of considerable variation in experimental methodology. The differences in species, apparatus, and the nature of the instrumental response are readily apparent. The altered motivational conditions should be emphasized; there was neither punishment for errors nor any primary drive reduction.

E. SUMMARY

1. *Experiment I*

Each of eight cats learned two simultaneous and two successive discrimination learning problems in the Wisconsin General Test Apparatus. Almost four times as many errors were made in learning the successive as in learning the simultaneous problems. The difference was significant at the 1 per cent level of confidence.

2. *Experiment II*

A group of four cats were trained on four simultaneous discriminations, while another group of eight learned four successive discrimination habits. The cats tested on the successive problems committed approximately three times as many errors as the simultaneous group in reaching the criterion of learning. The difference was significant at the 0.2 per cent level of confidence.

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The Journal of Genetic Psychology, 1956, **89**, 65-70.

INTERTASK TRANSFER IN CODE SUBSTITUTION LEARNING*

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A. INTRODUCTION

The experiments reported here were designed to measure the amount of transfer between successive problems in a series of letter-symbol substitution tasks, and provided an opportunity to test with adult human *S*s two qualitative predictions derived from Harlow's (2) description of the formation of learning sets: (*a*) that *S*s which have been tested on a series of code substitution tasks will show a cumulative improvement in performance from problem to problem, and (*b*) that *S*s which have had experience on a number of different tasks will be superior in performance to those which have had an equivalent duration of practice on a single problem, when both groups are tested on unfamiliar codes.

B. METHOD

1. *Subjects*

The *S*s in the first experiment, 32 Antioch College undergraduates, were divided into equivalent experimental and control groups of 16 *S*s each on the basis of their first day's performance. Thirty additional Antioch students served as *S*s in the second study.

2. *Procedure*

a. Experiment 1. Sixteen different codes consisting of 16 letter-symbol combinations were used during the training period of this experiment. An attempt was made to construct codes of homogeneous difficulty by using geometrically regular symbols which varied in one or two dimensions within any single code, while selecting quite different continua of variation between codes. The four codes employed in the transfer session, in contrast, were chosen to sample a wide range of difficulty; this series consisted of

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*Received in the Editorial Office on December 4, 1954.

[1] This research was conducted at the Aero-Medical Laboratory, Wright-Patterson AFB, Ohio.

one code similar to those used in the training series and of three codes with dissimilar symbols: Chinese characters, nonsense syllables (20 per association-value), and modified Gibson figures (1).

The division of *S*s into experimental and control groups was accomplished in the following manner: On the first day, two *S*s were tested on each of the codes and then each of the pairs tested on the same code was divided so that two groups with approximately equal mean correct substitutions per five-minute-test period were formed (Experimental group: M-66.6, $\sigma = 24.4$; Control group: M-66.9, $\sigma = 21.2$).

Following assignment to the experimental group, each of the *S*s was tested on a different one of the 16 codes for the remaining 15 days of the experiment, the order in which the *S*s were tested on the codes being counterbalanced by use of a 16 by 16 latin square. Each of the *S*s in the control group was practiced on a different one of the 16 codes throughout the training period.

On the 17th day, both groups were tested on four additional codes on which none of the *S*s had previously practiced. This transfer session was, of course, designed to test the second hypothesis derived from Harlow's formulation of the learning set phenomenon. It was anticipated that the experimental group having been exposed to conditions more favorable to the production of a learning set would have an increased general capacity for code substitution learning and would, therefore, be superior in performance on these new codes to the control group. As in the training period each code was tested for five minutes. Five-minute rest periods intervened between successive test periods, and the order of testing the codes was counterbalanced by a latin square design.

b. Experiment 2. Since an additional objective of this series of experiments was the collection of normative data concerning the equivalence of alternate forms of letter-symbol substitution tasks, 10 codes were selected from the 20 training and transfer codes of the previous study by discarding those codes which were characterized by extremely high or low rates of substitution, by a large number of errors, or by relatively large variance. The *S*s in this experiment, as the experimental group of the first investigation, were all practiced on every one of the tests in the series in a counterbalanced order. Five tests were administered each day on two successive days; five minutes for rest intervened between successive five-minute test periods.

C. RESULTS

1. *Experiment 1*

The performance of the experimental and control groups, as measured by the groups' mean total correct substitutions for successive tests during the training and transfer portions of the experiment, is plotted in Figure 1. It will be noted that the control group increased its number of correct substitutions by 278 per cent during the training period, while the experimental showed an increment of 37 per cent. A simple analysis of variance performed on the scores of the experimental group indicated that the increase in performance made by this group during the training period was significant at the .001 per cent level of confidence ($F = 5.49$, with 15 and 210 *d.f.*).

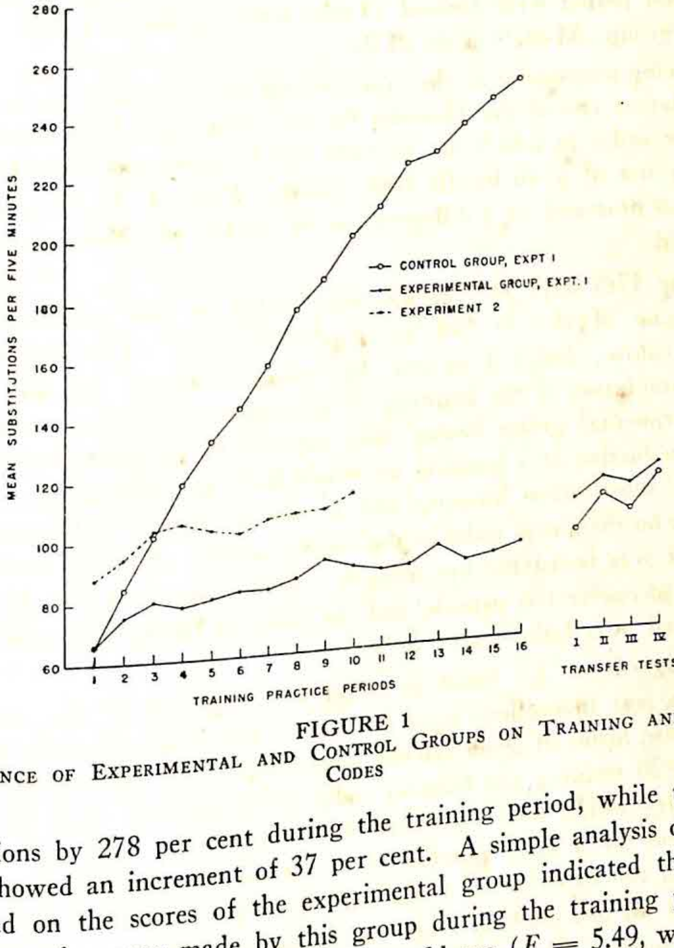

FIGURE 1

PERFORMANCE OF EXPERIMENTAL AND CONTROL GROUPS ON TRAINING AND TRANSFER CODES

The performance of the experimental group was, as predicted, superior to that of the control group on the codes tested during the transfer session.

However, the difference between the two groups was not statistically significant ($F = 1.05$, with 1 and 30 *d.f.*).

2. *Experiment 2*

The performance of this group, which was subjected to substantially the same conditions as the experimental group in the previous study, is plotted as the broken line in Figure 1. It should be remarked that the initial number of correct substitutions was greater than in the previous experiment owing, perhaps, to the elimination of the more unsatisfactory codes from the earlier series. The mean increment in total substitutions was 25.6 per cent and was again significant at the .001 confidence level ($F = 8.90$, with 9 and 252 *d.f.*).

D. Discussion

The results of these experiments indicate that positive evidence of the formation of a learning set may be obtained, even when adult humans are tested on a series of simple code substitution tasks. But these data also show that the magnitude of intertask transfer is relatively slight and that *S*s furnished with training calculated to facilitate learning set formation were not significantly superior, on a set of transfer tasks, to a group which had practiced a single code.

In view of the rather marginal results of this investigation and of a similar study of intertask transfer in the learning of lists of paired adjectives (2), it would be well to consider why one might not anticipate adult humans to exhibit any great degree of learning set formation in these situations.

Harlow (3, p. 53) has observed that ". . . the formation of a learning set is a highly predictable, orderly process which can be demonstrated as long as controls are maintained over the subjects' experience and the difficulty of the problem."

Now in this experiment, as in that of Greenberg and Underwood (2), the *S*s were sophisticated adults tested on simple and familiar materials. It may be postulated that college students have probably overlearned such habits as discriminating geometrical figures, of printing the letters "*A*" through "*P*," of turning pages, of forming meaningless associations, and the remaining skills involved in code substitution learning. Considering the age and experience of the *S*s and the simplicity of the task, it is probable that neither the *S*s' capacity for forming associations nor their work habits were modified appreciably by the practice given. One might more reasonably conclude that what intertask transfer has been demonstrated is a function of adaptation to the testing situation; at least this interpretation is consonant with the finding that, however the behavior of the experimental *S*s was modified during the training portion of the first experiment, similar changes occurred in the behavior of the control *S*s, since the groups did not differ significantly in their performance on the transfer task.

It would appear necessary, therefore, to use materials with which the average college *S* is unfamiliar in order to study changes in capacity or methods of work as mediators of intertask transfer independently of emotional adaptation. (Socio-emotional adaptation may, of course, be completed by months of pre-experimental gestling when *S*s are infra-human primates.) While Hebb (4) has given the discrimination of chimpanzee faces and the identification of thalamic nuclei as examples of suitably unfamiliar tasks, the importance of this variable can be illustrated by reference to studies of intertask transfer in verbal learning.

Greenberg and Underwood (2) found that learning how to learn adjectives by the paired associates method was "largely complete after learning and relearning a single list," while Ward (6) using the less familiar serial anticipation method, found intertask transfer over a series of 16 successive lists. Indeed, Melton and von Lackum (5) reported they found an improvement in the rate of learning serial lists of three-consonant nonsense units after 28 days in which numbers, words, and syllables had been learned by the anticipation method. It is suggested that the "learning how to learn" observed by Greenberg and Underwood experiment consisted almost entirely of adjustment to the laboratory situation, while prolonged intertask transfer found by the other experimenters was largely determined by the necessity for the *S*s dealing with a new kind of stimulus, nonsense syllables, and a new method of recitation, serial anticipation.

As an alternative to varying task difficulty, very simple problems may be used to define the significant variables in learning set formation when the *S*s are human children. Kuenne [cited by Harlow (3)] used the objects with which Harlow tested his monkeys to demonstrate the formation of a learning set in preschool children.

E. SUMMARY

Two experiments were performed to measure the amount of intertask transfer in code substitution learning. In the first experiment 16 *S*s were tested on a different task each day for 16 days, and 16 *S*s on the same task each day for 16 days. Both groups' performance was then compared on a series of four new transfer codes. Thirty *S*s were tested on five different codes a day for two days in the second study. The following results were obtained:

1. The two groups tested on series of different tasks showed increments of 37 and 25.6 per cent in their mean total substitutions per test period between the first and 16th and 10th tasks, respectively, which were significant at the .001 confidence level.

2. The group which had been practiced on the same tasks for 16 days was not significantly inferior to the group which had practiced different tasks each day, when both groups were compared on a series of transfer tasks.

3. An analysis of the results of the present investigation lead to the conclusion that the effects of adjustment to the learning situation were largely responsible for the intertask transfer found.

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The Journal of Genetic Psychology, 1956, **89**, 71-84.

A SEARCH FOR SYSTEMATIC PERSONALITY DIFFERENTIAE OF THE ONLY CHILD IN YOUNG ADULTHOOD*

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A. INTRODUCTION

The notion that the only child is somehow "different" in psychological make-up from children who have been reared with siblings is an old and persistent one. As in the past, the notion seems to be more widely held by the public at large than by the members of any selected group; how much of its sustenance comes, in this instance, from the wellsprings of folklore and tradition and how much from first-hand observations of behavior it is, of course, impossible to say.

Among the psychoanalysts, while the topic of the only child has never been extensively singled out for explicit discussion, it is generally accepted that family structure is a significant determinant of the pattern and intensity of the intra-familial dynamics and therefore of personality. It is but one step removed to reason that the only-child family constellation, being an apparently anomalous one, should offer greater potentiality for the development of personality anomaly. The occasional analysts [e.g., Flugel (10), Fenichel (9)] who have tended more or less explicitly to favor the notion that only children differ in personality from others, seem to have based their contentions on *a priori* thinking of this sort. However, at least one analyst of the past, viz. Brill (2), has claimed extensive first-hand empirical evidence in support of it, and several other analytically-oriented students of personality have made similar claims [e.g., Taylor (15), Clark and Capparell (5)]. All of these students point to some "abnormality"—in the negative sense—of the only child.

The psychologists, while they have speculated little regarding the topic under discussion, have experimented much. Indeed, the subject has through the years stimulated a sufficient volume of experimentation to have merited,

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*Received in the Editorial Office on January 7, 1955.

[1] Based, with some modifications, on a dissertation submitted to the Department of Psychology of the University of Pittsburgh in partial fulfillment of the requirements for the Ph.D. degree. The writer wishes to acknowledge the generous assistance of Dr. Jack Matthews, Dr. A. D. Lazovik, Dr. C. A. Whitmer, and Dr. A. W. Bendig.

in 1934, a review in the *Psychological Bulletin* (4) which reveals, among other things, that pertinent experiments were being carried out even before the turn of the century. Nor has the topic been neglected in the years since 1934. If, in an effort to summarize these studies, some sort of numerical tally of findings with respect to all of the various traits measured is made, it is found that, while occasional significant trait differences arise between groups of only and non-only children, the studies as a whole tend to weigh against the existence of differences. Upon first impulse, one might be tempted simply to accept the experimental evidence and to regard the issue as closed; but a second glance soon reveals that the large majority of these studies contains a number of flaws which give cause to call their findings into question. Among other things, many of the experimenters have been careless in their definition and selection of "only" and "non-only" children; the traits measured have been arbitrary and vague and have been selected without rationale; and the measuring instruments employed have been coarse and superficial. Regarding the last of these, for example, one might well inquire as to whether the evidence (assuming there is such) upon which the beliefs of the lay public and the psychoanalysts is based is of a different order and/or perhaps of a more subtle nature than that of the experimenters.

All of these considerations lead one to entertain doubt as to the validity of the experimental findings and supply justification for further research, provided that such research can be designed in a fashion which will minimize its vulnerability to them and to like criticisms. This the present experimenter attempted to do.

B. Problem

Having set up the general hypothesis that true "only-childness" is regularly associated (i.e., is correlated) with discoverable personality differences relative to true "non-only-childness," certain theorizing of Taylor, Fenichel, and Clark and Capparell was enlisted to provide a substratum upon which a loosely-formulated structure of hypothetical rationale concerning the possible nature of these differences might be built.

Taylor (15) studied a group of ostensibly well-adjusted adult only-children and purported to observe an unusually high incidence of neurasthenic and psychosomatic complaints among them. The implication was that, while satisfactory social adjustment was achieved, it was accomplished at a cost of developing certain "maladjustments" in the "deeper strata" of the personality of which the aforementioned symptoms were the manifestations. In an effort to explain the genesis and development of these manifestations, Taylor turned to certain earlier theorizing of Anderson (1) who held that socially motivated behavior develops within the primary family group during the period of 18 months to two years through a process of observation by the infant of the interactions among the infant himself and his parents and siblings. In the absence of siblings during this crucial period, the individual fails to incorporate social patterns and motives and there occurs instead an over-development of "ego-motives" whose repression in conjunction with later attempts at social adjustment results in the development of neurasthenic and psychosomatic complaints.

Fenichel (9, p. 574) emphasizes both the increased intensity of the Oedipal situation in the only child—a fact which enhances the danger of (presumably, primarily sexual) maladjustment—and the prevalence of the remnants of the pre-Oedipal mother fixation in women.

Clark and Capparell (5), noting a high incidence of only children among their adult patients, concluded, after a study of the dynamics involved, that the most prevalent manifestation among these only-child patients was their tendency to behave as "peripheral persons," that is, as persons who tend to remain on the periphery of virtually all social groups, being unable to integrate themselves into them.

From these as a starting point, the following loosely-formulated part-hypotheses were deduced:

1. Realms and levels of intergroup difference. Reasoning from Taylor, and Clark and Capparell, it was hypothesized that if two groups, one an only and the other a non-only group, were selected from an outwardly "normal" (in the sense of non-abnormal) population, significant intergroup differences would be found (*a*) in the "deeper strata" of the personality, (*b*) upon the level of symptomatology, and (*c*) in that area of environmental adjustment involving "belongingness" as measured by various aspects of group participation.

2. "Directions" of difference. In respect to (*a*) it was further reasoned that one might expect a higher incidence among only children of "internal maladjustment" in the basic structure of the personality, of heightened anxiety and, perhaps, of indications of (latent) homosexual tendency. Regarding (*b*), it was hypothesized that the only child group would evidence the greater tendency toward psychogenic symptomatology. Finally, with reference to (*c*), it was posited that the only child might be expected on the average to be "more peripheral" socially than the non-only child.

In order to implement the foregoing hypotheses, the experimenter selected as instruments the individual Rorschach Test (since it is generally held to be a "depth" test) and the Minnesota Multiphasic Personality Inventory (*MMPI*), which may be regarded as a modern refinement of the more superficial (i.e., relatively non-projective) instruments used by many of the previous experimenters and which aims at revealing symptomatology. In addition there was devised a questionnaire (entitled "Data Sheet") designed to give a rough estimate of the general "style of life" of the subjects during their academic years. The questionnaire was divided into two parts, the first concerning itself with the high school years, the second with the college years. Under each section, the subject was asked to give a complete list of all extracurricular and systematic non-school-connected activities, the length of time he participated in each, the offices held, and the length of time each office was held. Further information to be given included a detailed listing of all scholastic honors, scholarships, prizes, citations, and memberships in honoraries; a recent occupational history; a history of dating activities; an estimate of the average hours of study; and a complete listing of all hobbies and avocations systematically engaged in at the time of the experiment. A suitable scale of weights was developed for the various Data Sheet items so that quantitative comparison between groups could be made.

In order to test certain of the directional hypotheses discussed in 2 above, certain specific Rorschach signs were selected: among these were Davidson's (7) signs of adjustment, Elizur's (8) signs of anxiety, Wheeler's (17) signs of homosexuality (the latter two being based upon content), Brosin and Fromm's (3) signs of color and shading shock, and Hertz's (12) formula for estimating the degree of control over anxiety. In addition, the decision was made, despite absence of specific hypotheses, to compare both groups with respect to most of the major dimensions of the Rorschach plus Elizur's (8) signs of hostility based upon content.

The hypotheses were then restated (insofar as this was possible) in terms of the selected instruments and their various dimensions and scales. Thus, for example, with respect to the Rorschach, it was hypothesized that, among other things, the only children would show, on the average, significantly fewer of the Davidson signs of adjustment (hence, greater evidence of maladjustment); on the *MMPI*, in the absence of specific scales for measuring neurasthenic or psychosomatic symptomatology, it was posited, for example, that the only children as a group might be expected merely to show a larger total number of abnormal scores on the several scales; with respect to the Data Sheet, it was hypothesized that the non-only children would, on the average, score significantly higher than the only with respect to those items pertaining to gregarious or outgoing activities, while the only would score higher in those items which would commonly be expected to reflect isolated activity.

The subjects were 50 female college undergraduates, 25 of whom were only and 25 non-only. These were selected from a larger group of some 2,200 University of Pittsburgh students by administering in regular classes an elaborate questionnaire embodying the various criteria for selection or rejection of individuals in accordance with the following definitions and restrictions:

1. An "only" subject was defined as one who had never had any siblings or sibling-substitutes.
2. A definition of the non-only child was arrived at via the negative route of speculating upon what constitutes the essence of "onliness." It was decided that onliness is characterized by two major environmental deficiencies: first, the absence of intimate and continuous association of a child with other children *within the immediate family circle* during the earliest years of his life; and second, the absence in his experience of the event of displacement by a younger sibling during these early years. Accordingly it was decided that a "non-only" child would be one whose environmental differentiae relative to the conditions of the only child must include the following: The continuous presence in the immediate environment of two or more siblings, both of whom might be younger, but only one of whom might be older, than the subject; neither of whom might differ in age from the subject by more than five years in either direction; one of whom, be he younger or older than the subject, must have appeared on the scene prior to the subject's 30th month [see Anderson (1)]; and whose sex might be either female for both, male for both, or male for one and female for the other.

Care was taken to eliminate subjects whose family background was in any way abnormal or unusual or who had failed to live continuously within the stipulated environment with both parents (and for non-only subjects, with the required minimum number of siblings) at least from the time of their birth until their 15th birthdate. All persons selected as subjects on the basis of the questionnaire were interviewed briefly by the experimenter before final selection. Thus, the fact of college attendance *per se*, the information yielded by the preliminary questionnaire, and the impressions of the experimenter served together as the means by which the persons finally selected as subjects were adjudged as superficially "normal" or "well-adjusted." Only one person was eliminated as a result of the interview.

Pairs of only and non-only subjects were closely matched for a number of characteristics pertaining to themselves and their families, including total scores made by the subjects on the American Council on Education Examination (*ACE*), religion of subjects, level of education of parents, national origin of parents, and socioeconomic status of the family [as determined by a modification of Warner's (16) technique]. All subjects were American born whites.

The groups, as finally selected, resembled each other very closely, both in the central tendency and dispersion not only of all of the above characteristics, but also in respect to ages of subjects (mean age being 19.7 years for both groups), college year, courses of specialization and level of "general appearance" (as rated—for want of a better method—by the experimenter on a 5-point scale). Both groups ranged from the highest to the lowest socioeconomic and educational level of parents, with an adequate representation on all levels. The three major western religions were adequately represented in each of the two groups as were college year and area of specialization. Generally speaking, the groups were representative of the co-ed population at the University.

The subjects were tested individually by the experimenter, the tests scored by him [using the Klopfer (14) method] and checked by an associate. Suitable steps were taken to eliminate bias in scoring by having a third person remove all identifying marks from the record, assign a code number to each, and intermix the records of the two groups before turning them back to the scorers.

C. Results

In the tables which follow, two sorts of information are generally given for each set of scores, signs, or answers: first, a general characterization of obtained values in terms of a measure of central tendency and of dispersion; then tests for significance of differences between groups. In most instances, because of the presence of extreme values and because of the general non-normality of the data, it was judged desirable to use percentile measures of central tendency and of dispersion in preference to those which, like the mean and standard deviation, tend in such instances to misrepresent the findings by their overweighting of extreme values. P_{90-10} is used in preference to the quartile deviation because of its greater reliability. Significance tests employed in the study were chi-square, the *t*-test, and a non-parametric statistic known as the "sign test of significance (z)" (13). For chi-square and t, the formulae used throughout were those for correlated samples and that for chi-square included Yates' correction for continuity.

In treating the Rorschach data (and also that for the Data Sheet), the present experimenter attempted to adhere to the rules of statistical propriety set forth by Cronbach (6) in his definitive article on the handling of this test.

1. *Rorschach Findings*

As based upon the clinical judgment of the experimenter (and contrary to expectation, at least for the only group), the Rorschach protocols of both groups seemed largely to fall well within the range of the "normal." The most frequent sort of "abnormality" exhibited by the records was that of the hysterical variety. All in all, there were some six or seven such records distributed fairly equally between the two groups. One of the only-child records manifested depression while a second showed an unusual amount of hostility. One of the non-only records appeared rather "paranoid."

Table 1 summarizes the distribution of the subjects of both groups with respect to major categories of Rorschach scoring, while Table 2 displays the results of tests of significance of differences between groups with respect to some of these, plus those for certain of the more important derived ratios.

TABLE 1

MEDIAN AND P_{90-10} OF RESPONSES FALLING IN CERTAIN OF THE MAJOR SCORING CATEGORIES OF THE RORSCHACH AS MANIFESTED BY THE ONLY AND NON-ONLY GROUPS

Scoring category	Median		P_{90-10}	
	Only	Non-only	Only	Non-only
R	26	26	31.5	37.5
M	3	3	12.0	8.0
FM	5	4	10.5	7.0
m	0	0	1.0	2.0
FK	0	0	3.0	1.5
K	0	0	1.0	2.5
k	0	0	1.0	1.0
F	10	10	22.5	21.0
Fc	2	2	4.5	5.0
c	0	0	1.0	1.0
C′	0	1	1.0	4.0
FC	5	8	4.0	6.5
CF	1	1	4.5	4.0
C	0	0	0.0	1.5
A + Ad	10	13	21.5	14.0
H + Hd	5	6	14.5	11.0
At	1	1	4.0	3.5
W	7	9	12.5	10.5
Dd	1	1	7.5	7.0
S	0	0	1.5	3.0
P	5	5	3.0	4.5
$R_{\text{VIII, IX, X}}$	10	9	11.5	23.5

Table 1 tends to show a similarity between groups which is borne out in subsequent tables. Table 2 indicates that of the 32 sign tests computed, only one—viz., the average reaction time to colored cards—is significant at the 5 per cent level; this ratio of significant to non-significant values is about what might be expected on the basis of chance—assuming independent differences, which, incidentally, is not the case here. In any event, no great importance can be attached to the presence of the single significant difference among so large a number.

One might at first glance be inclined to attach some significance to the fact that an appreciable majority of the differences (viz., 20 out of 32) even though non-significant, tend to preponderate algebraically in the non-

TABLE 2

A COMPARISON* OF ONLY AND NON-ONLY GROUPS WITH RESPECT TO CERTAIN OF THE MORE IMPORTANT DIMENSIONS OF THE RORSCHACH

Dimension	z	P_z
Total R	0.00	.99
Total time	—1.80†	.07
Average time per response	—1.80	.07
Average RT	—0.80	.42
Average RT to color cards	—2.20	.03
Average RT to shaded cards	—1.00	.32
Total M	—0.20	.84
M/R (i.e., M%)	0.20	.84
Total FM	0.00	.99
FM/R (i.e., FM%)	1.20	.23
M/ (Fm + m)	—1.60	.11
Total FC	—0.80	.42
FC/R (i.e., FC%)	—1.40	.16
FC/ (CF + C)	—1.00	.32
Sum C	—1.00	.32
M/sum C	0.60	.55
$R_{VIII, IX, X}/R$	1.00	.32
Total Fc	—0.20	.84
Fc/R (i.e., Fc%)	0.20	.84
FK + K + k	0.60	.55
(FK + K + k)/R	—0.40	.69
Sum C/ (Fc + c + C′)	0.00	.99
F%	0.60	.55
(FK + F + Fc)/R	0.60	.55
Total P	0.00	.99
P/R	0.60	.55
A%	—1.20	.23
H%	—1.00	.32
At%	—1.20	.23
W%	—0.80	.42
W/M	—0.20	.84
(Dd + S)/R	—0.80	.42

*By means of the "sign test" (see ref. 13).

†The minus sign indicates that the preponderance lies with the non-only group.

only group. (Especially is this likely when it is also observed that no significant intergroup difference exists with respect to total R—even, incidentally, when the *t*-test is applied—and that a number of the items, for example, certain of the ratios, would in any event remain relatively uninfluenced by the total R.) Reflection will show that, for one thing, certain of the signs (notably certain of the ratios) are the result of artifacts in the treatment of the data, and, for another, that it is not unanimity of direction of signs, but rather meaningful patterning of plus and minus signs, which is of importance. The number of such patterns deducible from the hypotheses is small and, where they are fulfilled, as, for example, in the case of the higher F%, lower sum C and lower FC/CF plus C)-ratio for the only group (deducible from the theorizing of Taylor), coupled with the more introversive experience balance (M/sum C) for this group, they turn out to be lacking in significance of difference as between the two groups. Certain more meaningful patterns are treated in Tables 3, 4, and 5.

In Table 3, which compares the two groups with respect to Davidson's

TABLE 3

A COMPARISON OF ONLY AND NON-ONLY GROUPS WITH RESPECT TO THE PRESENCE OR ABSENCE OF DAVIDSON'S* SIGNS OF ADJUSTMENT

Number	Sign	Chi-square	P
1	M equal to or greater than FM	0.12	.73
2	M equal to or greater than 3	0.00	.99
3	Sum C greater than Fc + c + C′	0.00	.99
4	F% equal to or less than 50, but not less than 20	0.10	.76
5	Sum of Dd + S equal to or less than 10% total R	0.56	.47
6	P equal to or greater than 4, but not more than 30% R	0.12	.73
7	R greater than 20	0.10	.76
8	FC equal to or greater than CF	0.08	.78
9	FC equal to or greater than 2	0.36	.56
10	Complete absence of pure C	—‡	—
11	Per cent of responses to the last three cards equal to or greater than 40% R, but not greater than 60% R	2.08	.16
12	FK + Fc equal to or greater than 2	0.36	.56
13	W:M equal approximately to 2:1	0.08	.78
14	A% equal to or less than 50	0.90	.36
15	Absence of color shock	1.23	.27
16	Absence of shading shock	0.12	.73
17	Absence of card refusals	—‡	—
Sum of signs†		0.10	.76

*Ref. 7.

†Cutting score was the median of both groups combined; thus comparison is based on number of records in each group exhibiting a number of signs equal to or greater than the combined median.

‡Least theoretical frequency of one or more cells too small to permit application of chi-square.

signs of adjustment, we find again a consistent absence of significant differences between only and non-only groups, a fact which constitutes a failure to substantiate the hypothesized differences in "adjustment in the deeper strata of the personality" between the two groups. Unfortunately, Davidson fails to provide us with norms for any given group; however, she reports (7) a study by Roman and Liff in which application of the signs was made to Rorschach protocols of seven college students (presumably males). The mean obtained there was 8.14 signs and the standard deviation 2.23 signs. For the present group the means were 10.44 and 10.56 for the only and non-only groups respectively, and the standard deviations were 1.96 and 2.28; a *t* calculated for the means came to .20.

Table 4 summarizes the distribution of both groups with respect to the various signs of anxiety, hostility, and homosexuality and indicates also the results of tests for the significance of differences between the two groups with respect to these signs.

Regarding the anxiety signs, Table 4 indicates that while only one of these—viz., that based upon content—is significant at the 5 per cent level of confidence, there is a general trend toward a higher incidence of all anxiety signs in the only group. (This is indicated by absence of minus signs.) Thus, the hypothesis of greater anxiety in the only group, though hardly substantiated, gains some plausibility. In addition, while the difference is best attributed merely to sampling fluctuation, it is interesting to note that the

TABLE 4

MEDIAN AND P_{90-10} OF THE ONLY AND NON-ONLY GROUPS WITH REGARD TO VARIOUS SIGNS OF ANXIETY, HOSTILITY, AND HOMOSEXUALITY, AND A COMPARISON* OF THE TWO GROUPS WITH RESPECT TO THESE SIGNS

	Number of signs					
	Median		P_{90-10}			
Signs	Only	Non-only	Only	Non-only	z	P_z
Anxiety:						
Shading shock	2	2	4.0	2.5	1.40	.16
Color shock	2	2	4.0	3.0	.40	.69
Shading and color shock combined	5	3	6.5	5.5	1.00	.32
Anxiety signs based upon content	12	10	15.5	13.5	3.20	.00
Control over anxiety†	1.0	1.0	4.2	4.7	1.20	.23
Hostility	5	4	13.5	6.5	.20	.84
Homosexuality	3	2	4.5	5.0	1.80	.07

*By means of the "sign test" (see ref. 13).

†Values are based upon scores computed by means of the formula (FSh-(ShF + Sh))wt. (See ref. 12.)

group which manifests the trend toward greater anxiety (viz., the only group) shows also the greater capacity to control it. The intergroup differences regarding hostility signs are clearly not significant, but those concerned with homosexuality border on significance at the 5 per cent level, thereby showing some small tendency to bear out the hypothesis regarding this variable. There is a hint that content may be a more subtle indicator of differences than other aspects of the Rorschach Test. The essential "normality" of both groups, as manifested in Rorschach protocols is corroborated by the obtained *MMPI* scores. Table 5 exhibits the number of scores falling outside the "normal" range as defined by the authors of the test (11): *T*-scores lying outside the range 30 to 70, inclusive, on any scale are regarded by them as "abnormal."

TABLE 5

TOTAL NUMBER OF *MMPI* *T*-SCORES IN EACH GROUP LYING OUTSIDE THE RANGE 30 TO 70 AND NUMBER OF INDIVIDUALS EARNING THESE SCORES

Group	Total number of scales	Scores above 70	Number of subjects earning scores above 70	Scores below 30
Only	225	5	4	1
Non	225	2	2	0
Totals	450	7	6	1

The various descriptive and significance statistics relating to the nine scales of the *MMPI* are displayed together in Table 6.

It is clear from Tables 5 and 6 that our groups fail to show significant differences either within or without the "normal" range, and consequently that our hypotheses in this regard fail to be substantiated.

TABLE 6

MEAN *T*-SCORES, STANDARD DEVIATIONS AND *t*-VALUES FOR SCALES OF THE MINNESOTA MULTIPHASIC PERSONALITY INVENTORY FOR ONLY AND NON-ONLY GROUPS

Scale	Only Mean	Only *SD*	Non-only Mean	Non-only *SD*	*t*
Hypochondriasis	49.00	5.83	49.44	5.44	0.26
Depression	49.12	8.33	46.76	7.90	1.11
Hysteria	53.80	6.32	54.88	7.30	0.63
Psychopathy	55.44	9.77	54.76	10.42	0.27
Masculinity-femininity	47.92	8.59	49.72	7.26	0.93
Paranoia	54.52	9.59	54.44	8.44	0.03
Psychasthenia	51.44	5.28	53.52	8.01	0.97
Schizophrenia	51.56	6.70	53.76	6.59	1.17
Mania	54.88	9.44	56.80	9.66	0.72

Table 7 displays both the descriptive and the significance statistics derived from the answers to the Data Sheet. Regarding the matter of activities engaged in during the high school and college years, a simple *a priori* method of weighting was used which ranged between one point, assigned for the first year of mere membership in any organization, to five points given for each year of presidency of a major organization. Space precludes giving further details here. With respect to the item on scholarships, a scholarship was not credited if awarded for reasons other than scholastic achievement or ability.

TABLE 7

A COMPARISON OF ONLY AND NON-ONLY GROUPS WITH RESPECT TO THEIR ANSWERS TO THE QUESTIONS OF THE "DATA SHEET"

Topic of question	Median Only	 Non-only	P_{90-10} Only	 Non-only	z	P_z
Extent of participation in activities during high school (score)	14.5	21.5	16.4	37.0	—2.00	.04
Extent of participation in activities during college (score)	3.0	4.0	7.0	12.5	—1.40	.16
No. dates per month	5	4	8	9	—0.20	.84
Age at first date (yrs.)	15	15	3	4	0.20	.84
Number of hobbies	1	1	3	2	0.40	.69
Hours per week spent in hobbies	2	3	14	18	0.45	.65
Hours of study per week	15	10	29	21	1.92	.05
	No. subjects answering affirmatively Only	 Non-only	Chi-square	P		
High school honor roll	21	17	0.90	.36		
Possession of scholarships or memberships in honorary societies or both	10	12	0.12	.73		
Present employment, or employment during the preceding summer, or both	14	18	0.00	.99		

In Table 7, the preponderance of non-significant differences is again apparent. However, the two such differences which do appear are consonant in direction with the earlier theorizing. There is apparently a great drop for both groups in the extent to which they participate in voluntary group activities (both in school and out) as they pass from high school to college. This may be interpreted as reflecting among other things a tendency for the maturing student to take her studies more seriously. While the difference between groups in this variable becomes non-significant on the college level, the ratio of scores remains relatively the same and the difference continues to favor the non-only group. In harmony with this is the tendency of the only child to (continue to?) devote more time to her studies. It should be noted also that, unlike the patients of Clark and Capparell (5), the "normal" only child participates widely in group activities.

As for the remaining data of Table 7, these are best interpreted as reflecting a chance relationship and merit little comment other than that necessary to point out that they fail to bear out the hypothesized patterns.

To characterize the study as a whole in a few words, it may be said that the instruments as applied failed for the most part to reveal the hypothesized differences between groups of "normal" only and non-only subjects. Nevertheless, the few significant differences which did emerge, coupled with certain patterns which, while constituted of largely non-significant elements, tend to favor the hypotheses, suggest the desirability of replication. Finally, the possibility exists, now as before, that the failure to find significant differences rests upon the ineptness of our hypotheses, our methods, or our instruments, or upon some combination of these.

D. SUMMARY

A number of loosely-formulated hypotheses regarding certain personality and behavioral characteristics in which the "normal" only child might on the average be expected to differ from the "normal" non-only child were deduced from the thinking and research of certain largely psychoanalytically-oriented students of personality. The individual Rorschach Test, the Minnesota Multiphasic Personality Inventory, and a specially constructed "style-of-life" questionnaire (termed "Data Sheet") were selected to test these hypotheses.

Two groups, one consisting of 25 only and one of 25 non-only S's were then drawn from a larger group of some 2,200 University of Pittsburgh students. All were ostensibly "normal" college females coming from relatively "normal" backgrounds. Each only S was carefully matched with a non-only S in regard to such characteristics as intelligence, education, religious background, etc. The aforementioned instruments were then administered to each of the 50 S's.

The results of the study were essentially negative, but patterns of difference were such as to suggest the desirability of replication. Further, it was judged possible that the use of other approaches or techniques might show differences where the present ones had failed to do so.

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The Journal of Genetic Psychology, 1956, **89**, 85-93.

PRESTIGE SUGGESTION IN CHILDREN'S ART PREFERENCES*

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A. THE PROBLEM

This study seeks empirical answers to the question of whether fourth and fifth grade children are responsive to the influence of adult opinion in matters of art preference. It is also concerned with the reliability and generality of individual differences in this type of suggestibility and with the question of whether degree of suggestibility is related to the kind of motivation underlying it.

Some of the more recent and better-known studies of suggestibility (6, 10) have tended to indicate that children are not very responsive to adult prestige suggestion or, at any rate, respond less to the suggestions of adults than to those of peers. Since we felt that these experiments were not generally representative of situations in which adults attempt to influence the value judgments of children and, hence, that the findings were partly a function of various special features of experimental design, we endeavored to measure the susceptibility of children's value judgments to adult influence under more typical conditions of adult-child interaction. The art preference situation previously used to measure the suggestibility of university students (11, 12), was regarded as admirably suited to this purpose.

In accordance with recent efforts to identify the personality correlates of individual differences in suggestibility (1, 5, 9, 13, 16), we were also interested (*a*) in ascertaining the intra- and inter-situational generality of our suggestibility measure in children, and (*b*) in relating the magnitude of individual suggestibility scores to personality variables differentially associated with the motivational basis of suggestibility. We hypothesized that, in general, individuals are motivated to accept the suggestions of others with respect to the value judgments they form for one or both of two main reasons (not necessarily mutually exclusive), designated satellizing and non-satellizing respectively (3, p. 136). The satellizing basis of suggestibility is predicated upon

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*Received in the Editorial Office on January 25, 1955.

[1] This study was supported by grants from the Bureau of Educational Research and the University Research Board of the University of Illinois.

feelings of personal loyalty or emotional allegiance to another person, upon a desire to be like him and to share his values irrespective of considerations of expediency or self-enhancement. The non-satellizing basis of suggestibility, on the other hand, is predicated, consciously or "unconsciously," upon such factors as fear of punishment or social disapproval and upon implied promises of reward or support in the quest for status.

In the present study we proposed to test intra-situational generality by determining the split-half reliability of individual suggestibility scores on the *Art Preference Test*, and to test inter-situational generality by relating the latter scores of our subjects to their tendency to accept the value judgments of their parents. And by correlating suggestibility scores with two independent measures of satellizing and non-satellizing trends, we proposed to ascertain whether degree of suggestibility in children was related to this dimension of personality structure which provides, at least in part, the underlying motivational basis for acceptance of others' suggestions.

B. METHOD

1. *Population*

The subjects in this study were 40 fourth and fifth grade children (21 boys and 19 girls) drawn from two elementary schools in Champaign-Urbana, Illinois. Twenty children were selected from each school and from each of the two grades. The mean age of the boys was 10.2 when the study began, and the mean age of the girls was 10.1. All of the children were white and representative of a wide range of social class backgrounds.

The data on which this particular study is based were collected during the course of an after-school arts-and-crafts program meeting 90 minutes twice weekly for a semester. Two of the junior authors administered the instruments described below, and the third served as arts-and-crafts instructor.

2. *The Art Preference (Suggestibility) Test*

This test consists of eight pairs of lantern slides, each slide representing a painting. In order to obtain virtual unanimity of preference for one member of each pair, a conventional painting is paired in each case with an ultramodernistic abstract painting. The slides are projected one at a time on a white screen. After each pair is presented, the subjects are requested to circle the words "first" or "second" on a numbered answer sheet in accordance with their individual preferences. The order of presentation (first or second) of conventional and abstract paintings is randomized to minimize serial effects.

The test was administered late in the semester by one of the experimenters who was introduced by the arts-and-crafts instructor to the subjects as an "expert" on art and painting. In the first (pre-suggestion) session, the subjects were simply instructed to express their sincere preferences without consulting their neighbors. One week later the test was administered again. The experimenter introduced this session by stating that he was going to give his own opinion of the paintings because he had observed that persons often change their ratings of works of art after various features of the artist's conception and technique are pointed out to them. The slides were then presented in pairs as in the first session. In an informal, spontaneous manner the experimenter made several favorable comments about the abstract painting and several unfavorable comments about the conventional painting in each pair. The subjects expressed their preferences immediately after the presentation of each pair of slides with the accompanying commentary.

3. *Other Instruments*

Agreement With Perceived Parent Opinions was intended as a parallel but more indirect measure of children's susceptibility to parental influence in the formation of their value judgments. A subject's score on this instrument reflects the extent to which his expressed opinions are in agreement with perceived parent opinions on various issues concerning parent-child relationships (e.g., home chores, discipline, privileges). The subject first rates 41 such statements on a five-point scale of own agreement or disagreement with same. One week later he rates these same statements in accordance with his perceptions of his parents' opinions regarding these issues. The score given each subject on this test is the sum of the discrepancies between own and perceived parent ratings (irrespective of direction of difference) on all 41 items. The corrected split-half (odd-even) reliability coefficient of these scores was .51.

The *Moral Responsibility Test* was designed to differentiate between satellizing and non-satellizing acceptance of moral values. The subjects (on a personal interview basis) are presented with 11 purportedly true situations, each dealing with a moral problem confronting a boy or girl of their own age (e.g., cheating, lying, stealing), and are asked to evaluate the moral behavior involved and to indicate the reasons underlying their judgments. Responses are scored as satellizing if they indicate unquestioning acceptance of a moral principle or fear of punishment, and as non-satellizing if reference is made to abstract concepts of equity and reciprocity. The corrected split-half (odd-even) reliability of these scores was .55.

The *Hero Worship Test* was designed to distinguish between satellizing and non-satellizing trends in identifying with an admired person. Satellizing hero worship was defined as the tendency to identify in a subservient capacity with the admired individual in order to derive a purely vicarious status; non-satellizing hero worship was defined as the tendency to use the admired person as an emulatory model and stepping stone for the furthering of own status, i.e., to become like the latter and to use his influence in order to gain a comparable status.

This test consists of three hypothetical encounters between the subject and hero in which the former expresses a preference for one of four rôles in relation to the latter. In each case the rôles are ordered on a satellizing-non-satellizing continuum. The heroes used for the boys are the Lone Ranger, Roy Rogers, and Tarzan. The heroines used for the girls are Queen Elizabeth, Dale Evans, and Florence Nightingale. Responses are scored on a one to four basis in accordance with position on the above continuum. An individual's score on the test is computed by summing his responses to the three stories. Generality over items was tested by obtaining contingency coefficients between the subjects' responses on each of the three pairs of stories. The mean contingency coefficient for the boys was .74 ($P < .01$); for the girls, it was .60 ($P < .01$).

C. RESULTS

In accordance with our purposeful manipulation of the pairings in the *Art Preference Test*, the overwhelming majority (92.8 per cent) of our subjects initially preferred the conventional to the abstract, ultra-modernistic paintings. More boys (9.5 per cent) than girls (4.6 per cent), however, favored the abstract member of each pair at this time ($P < .05$).

Immediately following the presentation of "expert" opinion, the percentage of preferences for the abstract paintings rose from 7.2 per cent to 34 per cent for the group as a whole ($P < .001$). The change for the boys was from 9.5 per cent to 30.8 per cent. The corresponding change for the girls was from 4.7 per cent to 37.2 per cent. Thus, although the girls originally preferred the abstract paintings less than did the boys, they responded significantly more than the boys did ($P < .01$) to the evaluative comments of the experimenter.

Individual suggestibility scores were computed by dividing a given subject's actual preference reversals by the total number of possible reversals he could have made. If, for example, he initially preferred six out of eight conventional paintings and subsequently preferred only four of the latter, his suggestibility score would be 2/6 or .33. The distribution of individual suggestibility scores, shown in Figure 1, indicates that most individuals in our population were only partially responsive to prestige suggestion. Approximately half of the group changed their preferences less than 20 per cent of the time after exposure to adult expert opinion.

The responsiveness of our subjects to prestige suggestion in the *Art Pref-*

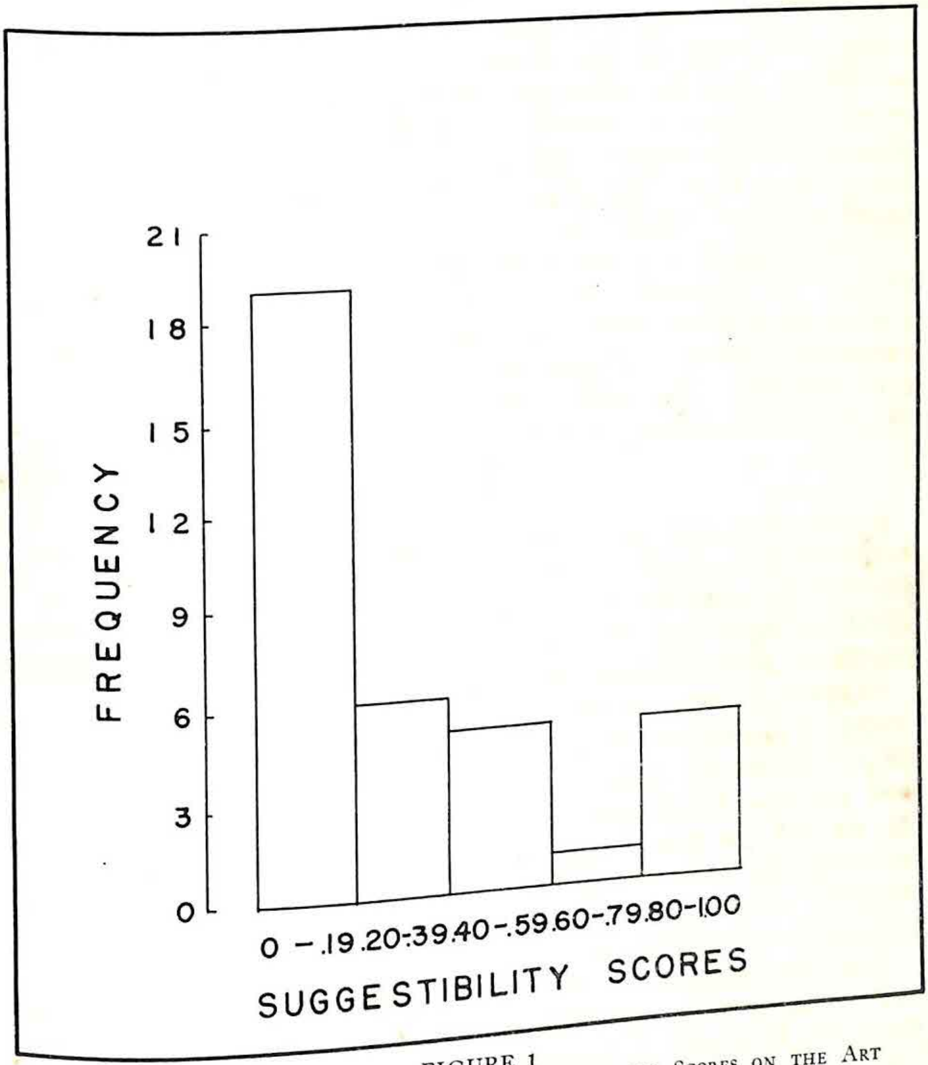

FIGURE 1
FREQUENCY DISTRIBUTION OF INDIVIDUAL SUGGESTIBILITY SCORES ON THE ART PREFERENCE TEST

erence Test showed considerable intra-situational generality over the eight paired items. The corrected split-half (odd-even) reliability coefficient of the test was .88.

When individual suggestibility scores were correlated with a comparable measure, namely, agreement with perceived parent opinions (in order to test for inter-situational generality), the resulting correlation (.14) was negligible and not significant. Hence, in our population the tendency for children to accept the art evaluations of an adult expert was unrelated to their disposition to accept the values they perceived their parents holding with respect to common disciplinary problems.

Individual suggestibility scores were also not significantly related ($r =$ .25) to satellizing explanations of moral behavior on the *Moral Responsibility Test* or to satellizing responses on the *Hero Worship Test* ($r = —.27$).

D. Discussion

In contrast to the findings in Duncker's study of children's taste preferences (10) and Berenda's study of line length judgments (6), the children in the present experiment exhibited considerable responsiveness to adult prestige suggestion with respect to art preference. How can these differences be explained? First, the tasks employed in the earlier studies were of such a nature as to arouse children's resistance to adult influence. In matters of food preference, children perceive adults as governed by nutritional considerations rather than by taste appeal, and hence are more disposed to follow the example of other children. On the basis of past experience with the use of trick questions and demonstrations as a pedagogic device, school children also tend to be wary of a hoax when a teacher asserts that a 4¾-inch line is longer than a 5-inch line. Second, art preference is a more ambiguous area of judgment for children than food preference or line length comparison; in the former area of judgment the child has relatively little past experience, an indefinite and unformed frame of reference for evaluation, and no incontrovertible sensory evidence before him. Third, the attempt at rationalizing expert opinion in the *Art Preference Test* is more typical of the usual conditions of adult influence than the arbitrary, unexplained suggestions of teachers in the other two situations. The same findings hold true for adult subjects, whose art preferences are not significantly influenced by arbitrary majority example (9) or by attributing the names of famous artists to paintings (12), but are significantly influenced by evaluative descriptions of paintings (11). In the absence of mere arbitrary suggestion, Duncker has been able to induce significant changes in children's taste preferences even more indirectly by attributing preference for unpalatable foods to the hero of a story (10).

The evidence of greater suggestibility in our girl subjects is in accord with the majority finding of previous investigations concerned with sex differences in suggestibility (e.g., 8, 10). In accounting for this difference, there is little choice but to attribute it to the fact that girls are trained to be "ladylike," "compliant," and "not to contradict" (7, p. 275).

The relatively high split-half reliability of our individual suggestibility scores parallels Crutchfield's finding for adult subjects in which several different judgmental tasks were utilized within the framework of the same arbitrary majority influence situation (9). However, the issue of intersituational generality which is closely related to the question of whether suggestibility can be considered a general personality trait is still a very unsettled matter. Our finding that suggestibility scores on the *Art Preference Test* were not significantly related to children's expressed degree of agreement with perceived parent opinions must be qualified by several considerations. First, the intra-test generality of the latter measure was not very high. Second, the two kinds of situations are really quite different, one involving more long-range and incidental exposure to parental influence, the other involving less prolonged and more explicit exposure to the influence of a much less intimately related person. Third, generality coefficients tend to be consistently lower for children than for adults on practically all personality variables.

The fact that degree of suggestibility in our subjects was apparently unrelated to whether the trait had a satellizing or non-satellizing motivational basis is the most difficult finding of all to explain. As above, this finding must be qualified by the limited intra-test generality of the instruments measuring the latter variable, and by the generally low intercorrelations that are found for presumably related character traits in children. Studies of the personality correlates of suggestibility in adult subjects (5, 9, 13, 16) indicate that this variable is consistently associated with a cluster of temperamental and personality traits that have been designated as characteristic of the "authoritarian personality." The highly suggestible individual has been found to be vacillating, submissive, inhibited, unable to tolerate hostility, and intolerant of ambiguity; to idealize his parent, to hold restrictive attitudes in relation to children and positive attitudes toward authority, and to blame himself for discrepancies between own and group judgments (9, 13, 16). Personality investigations of the non-suggestible individual, on the other hand, have found him to be ascendant, self-sufficient, self-assertive, independent, and able to think for himself (9, 13, 16). He does not like to take orders, does not want to get along with everyone, does not value strict discipline, and holds more critical attitudes toward his parents and less critical attitudes toward children (5, 9).

In reconciling the above findings with our own, the following formulation seemed most defensible: The least common denominator of the personality variable associated with resistance to others' influence appears to be a temperamental factor of self-sufficiency, self-assertiveness, and ability to maintain self-respect in the absence of external support or approbation. *Degree* or *amount* of suggestibility, therefore, would tend to be at a high level in an individual who, by virtue of hereditary endowment or upbringing by domineering parents, ranks relatively low with respect to this temperamental factor. The *motivational* basis of his suggestibility, however, is quite another matter. It is determined in part by his position on a satellizing-non-satellizing continuum and is apparently unrelated to relative degree of suggestibility. In the art preference situation, for example, the motivational basis of the subject's suggestibility is not at all implicit in his responsiveness to expert opinion; he could be suggestible on either a satellizing or a non-satellizing basis. However, when suggestibility scores are correlated with independent criteria of these latter trends (i.e., scores on the *Hero Worship Test* and the *Moral Responsibility Test*), it appears that the motivational basis of suggestibility does not significantly influence the extent to which the trait is expressed. We would tentatively conclude, therefore, that degree of expression and motivational basis of suggestibility are determined by separate and independent dimensions of personality structure.

E. SUMMARY AND CONCLUSIONS

The responsiveness of 40 fourth and fifth grade school children to adult expert opinion was tested by means of an *Art Preference Test*. Following exposure to the evaluative comments of an adult expert, expressed preference for abstract over conventional paintings rose from 7.2 to 34 per cent ($P < .001$). Boys initially showed greater preference for the abstract paintings than did the girls, but the latter were significantly more responsive to adult opinion.

A split-half reliability of .88 for the individual suggestibility scores indicated relatively high intra-situational generality for this measure. Suggestibility scores were not significantly related to subjects' expressed degree of agreement with perceived parent opinions or with two measures of satellizing and non-satellizing trends in accepting moral values and in identifying with admired persons. The latter findings were regarded as consistent with the interpretation that degree of expression and motivational basis of suggestibility are determined by separate and independent dimensions of personality structure.

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The Journal of Genetic Psychology, 1956, **89**, 95-103.

SYNESTHESIA IN CHILDREN: ASSOCIATION OF COLORS WITH PURE TONE FREQUENCIES*

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A. INTRODUCTION

Previous studies of music-color (2, 4) and music-graphic form (3) associations have suggested that synesthetic experience is neither restricted to relatively few atypical individuals nor is wholly idiosyncratic in the particular cross-modality associations that are formed. Such experience was found to be both widely distributed and relatively homogeneous among unselected subjects.

These findings tend to support the view that particular auditory-color associations are established more or less uniformly within a given culture, possibly as a result of the individual members being similarly exposed to frequent, concomitant presentations of the dual sensory qualities in question. In these experiments, however, the influence of cultural conditioning was *maximized* because adults were used as subjects and because structured musical selections were used as the source of auditory stimulation. Since highly standardized qualities of *both* musical and color experience are conventionally employed to create or symbolize particular moods, specific, culturally stylized synesthetic associations would naturally tend to be established more readily between color and music than, for example, between color and isolated tones. Such associations would be formed indirectly on the basis of parallel relationships between the two sensory modalities and various qualities of mood.

In view of these considerations of experimental design which provided little opportunity for the operation of more intrinsic determinants of pitch-color synesthesia, it was deemed worthwhile to conduct a comparable investigation among unselected subjects that would *minimize* the influence of cultural conditioning. This was accomplished in the present study (*a*) by using elementary school children as subjects, and (*b*) by employing pure tone frequencies as the source of auditory stimulation. In the first place, the cumulative impact of culturally determined experiential concomitance could be reasonably expected to be less pronounced in children than in adults.

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*Received in the Editorial Office on February 3, 1955.

Second, particular single tones, in contrast to structured musical experience, are not conventionally used to represent specific moods. Hence, if distinctive color-pitch associations appeared under such conditions, they could with some justification be attributed to more intrinsically determined relationships between the two modalities rather than to the effects of cultural conditioning.

The present study, therefore, was designed primarily to answer the question of whether children tend to associate certain spectral colors significantly more frequently with certain pure tone frequencies than with others. An attempt was also made to ascertain whether color-tone associations are significantly affected by the sex membership of the subjects and by variation in the intensity of the auditory stimuli.

B. METHOD

The basic procedure followed in this study was to present the subjects with a series of six pure tone frequencies and to have them indicate which of six spectral colors they "thought of" immediately after hearing each of the tones.

1. *Population*

All 1,096 pupils of an urban school system who were in grade three, four, five, and six were tested with the exception of a few absentees, while 101 subjects were eliminated from consideration because of significant hearing impairment in one or more frequencies or because of failure to record one or more color reactions to the auditory stimuli.

The population upon which the results are based was made up of a total of 995 pupils (472 boys and 523 girls) distributed by grade as follows: sixth: 171 (78 boys and 93 girls); fifth: 256 (116 boys and 140 girls); fourth: 249 (117 boys and 132 girls); third: 319 (161 boys and 158 girls).

2. *Preparation of Color Stimuli*

All of the spectral colors except indigo were used. Ranging from high to low frequency they included violet, blue, green, yellow, orange, and red.

Each child in the experiment had an inch-square piece of paper of each of these colors in front of him during the experiment. These squares of paper were pasted on rectangular strips (2 inches by 11¾ inches) of light tan manila paper. Under each square of colored paper was placed the first letter of that color, i.e., R for red, O for orange, etc.

To eliminate the possible influence of positional and serial effects on the frequency of choice, 25 different random arrangements of the six colors were prepared using a table of random numbers.

3. *Presentation of Sound Stimuli*

Pure tone frequencies selected as sound stimuli were 125, 250, 1,000, 4,000, 8,000, and 12,000 cycles per second. Each frequency was presented twice, once with 40 decibels and once with 50 decibels. Thus, in all, each subject reacted to 12 pure tone sound stimuli. Eight different arrangements of order of presentation were prepared as above to minimize the possible influence of serial effects.

4. *Administration of Sound-Color Test*

Each group (containing a maximum of 20 pupils) used in this study took the standard group pure tone hearing test first. This procedure acquainted subjects with tones on the audiometer and also provided a check on the auditory acuity of each subject. When the hearing test was completed, each child received one of the manila strips described above and an answer sheet on which to indicate his color responses to the auditory stimuli.

The test was then given with the following directions:

> Please do not handle the earphones. Leave your pencils on your desks until I ask you to use them. We are going to play a game. On this card and on your cards are *six* colors. Under the color *red*, there is an R. Under the color *yellow*, there is a Y. Under *orange* is an O. Under *blue* is a B. Under *green* is a G. Under *purple* is a P. (Violet usually called purple in community.)
>
> In this game we are going to write these letters on these papers (answer sheets). (Directions were given for placing earphones on ears.) Now, I'm going to play a tone. Listen! You will look at the colors on the card and choose the one color you think of when you hear the sound.
>
> Let's try the game. Listen carefully. (The sound of 500 c.p.s. was played at 40 db. The illustrative sound was varied with different groups and the proper response was indicated on the blackboard.) Do you hear a sound? Maybe some of you feel *blue* goes with that sound. If you do you would put a B after number 1 on your paper. (Administrator demonstrates procedure for recording response but subjects record nothing.) Perhaps some of you will feel *purple* goes with that sound. Then you would write P after number 1 on your paper. Or you may feel *green* goes with the sound. Then you would write G after number 1, etc. (Each of other colors was mentioned by the test administrator.) After every sound we want you to give an answer. If you are not sure as to what color you feel, guess a color.
>
> Let's pick up our pencils. Remember, when you hear the sound, quickly look at the colors on your card and write down the color you feel.

C. Results

Table 1 shows the percentages of subjects selecting each of the six possible color choices upon presentation of pure tone frequencies ranging from 125 c.p.s. to 12,000 c.p.s. These data demonstrate unequivocally that when our 995 children subjects are required to make judgments of pitch-hue compatibility, definite and statistically significant differences emerge in the tendency for particular hues to be associated with particular tones. In general the color-pitch relationships obtained in this study are in agreement with results reported for adult subjects (1).

TABLE 1

Percentages of Subjects Choosing Each of Six Colors With Designated Sound Cycles Per Second Stimulation

Sound cycles per second (two intensities combined)	Percentage of subjects selecting					
	Red	Orange	Yellow	Green	Blue	Violet
125	13	15	9	12	28	23
250	16	17	10	15	26	16
1,000	21	20	17	14	16	12
4,000	20	15	20	19	14	13
8,000	18	14	23	18	12	14
12,000	18	14	25	19	10	13
Average of all frequencies	18	16	17	16	18	15

By plotting the percentages of subjects selecting a given hue against the six different pure tone frequencies for which color choices were made, a definite pattern emerges for each color (see Figure 1). These patterns may be grouped into three general categories in accordance with the predominant range of pitch associated with each of the colors: (*a*) *yellow* and *green* are predominantly associated with high-pitched tones (Figure 1a). In the case of yellow, the relationship between percentage of selection and elevation of pitch is practically linear. Green shows a similar but more irregular and less pronounced relationship to tone frequency. (*b*) *Red* and *orange* may be characterized as "middle-pitched" colors (Figure 1b). This designation is somewhat more apt for the inverted "V" pattern of orange than it is for red. Although red is mostly chosen at 1,000 and 4,000 c.p.s. and is infrequently selected at 125 c.p.s., the choices do not decline as steeply for the higher tones as in the case of orange. (*c*) *Violet* and *blue* are predominantly "low-pitched" colors (Figure 1c). The blue pattern reflects an almost linear relationship between percentage of choices and tone frequency that is practically the inverse of that described for yellow. Violet is also preponderantly chosen at the lower tone frequencies; but after reaching a minimum selection point at 1,000 c.p.s., it tends to be selected by a slightly higher percentage of subjects at 4,000, 8,000, and 12,000 c.p.s. Because of their somewhat symmetrical divergences from the "middle-pitched" and "low-pitched" patterns respectively, red and violet produce patterns that are the inverse of each other.

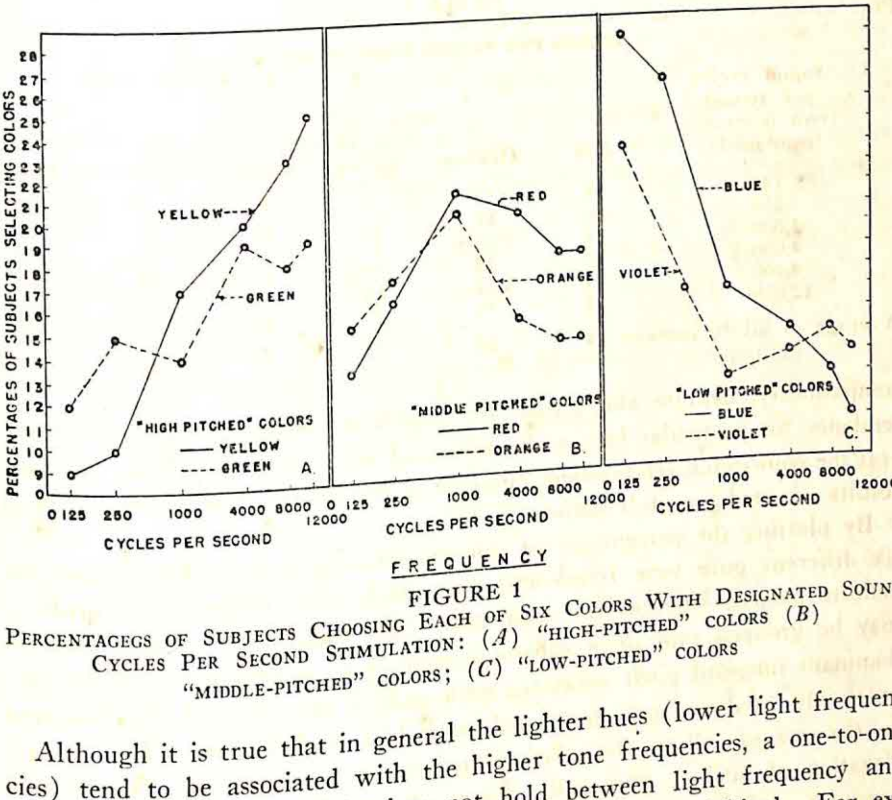

FIGURE 1

PERCENTAGEGS OF SUBJECTS CHOOSING EACH OF SIX COLORS WITH DESIGNATED SOUND CYCLES PER SECOND STIMULATION: (*A*) "HIGH-PITCHED" COLORS (*B*) "MIDDLE-PITCHED" COLORS; (*C*) "LOW-PITCHED" COLORS

Although it is true that in general the lighter hues (lower light frequencies) tend to be associated with the higher tone frequencies, a one-to-one inverse relationship certainly does not hold between light frequency and tone frequency in the synesthetic associations that are exhibited. For example, yellow, which is selected most at the higher tone frequencies, is a middle-spectrum color; and blue, which is more emphatically and consistently related to lower tone frequencies than is violet, occupies a less extreme position than the latter on the spectrum. On the other hand, a suggestion of spectral-tone frequency symmetry appears in the inverse pattern relationships described for red and violet (lowest and highest light frequencies) and yellow and blue (third lowest and third highest light frequencies). It would be interesting to observe whether this symmetry in inverse patterning would hold for orange and indigo, the second lowest and second highest light frequencies. Unfortunately, however, in an effort to keep the number of color choices from becoming unmanageable for our children subjects, indigo was not used in this experiment.

In general, few marked differences in color-pitch association were related to the 10 decibel difference in tone intensity. At 50 decibels, the contrast between the percentages of selection for yellow and blue in response to a 125 c.p.s. tone became even more striking than at 40 decibels. The few other noteworthy differences (in no case larger than five percentage points) showed no consistent trend. Sex differences were also relatively insignificant and inconsistent in direction. Differences of five or more percentage points occurred principally at 12,000 c.p.s. in relation to red, orange and yellow.

D. Discussion

In the light of current theories of synesthesia, we may consider three possible interpretations of the major finding of this study, namely, that on a forced judgment basis elementary school children tend to associate certain spectral colors significantly more frequently with certain pure tone frequencies than with others:

1. According to physiologically oriented theories, innate neutral connections exist between functionally differentiated portions of the auditory and visual cortical centers. Thus, for example, by virtue of such preformed connections, the experience of a particular pitch would be simultaneously accompanied by the experience of a particular hue.

Although it is difficult to disprove such a theory, little incontrovertible evidence or reasoning in support of it has been advanced. On purely neuroanatomical grounds it does not seem very plausible because: (*a*) the structural separateness of the visual and auditory pathways, as well as of their cortical centers, renders unlikely the possibility of innately established connections; and (*b*) even if such connections did exist, the genetically determined particularization of color-tone synesthesia on a simple associative basis would presuppose cortical localization of hue and pitch. Furthermore, the prevailing degree of variability between color and tone associations is hardly consistent with the relative invariance one would expect to find in instances of preformed neural connections. And lastly, before direct associations between hue and pitch could be postulated, it would first be necessary to eliminate the possibility of indirect associations based upon parallel relationships to a common mediating variable such as mood.

2. Theories stressing *cultural conditioning* generally invoke mood as an intermediate variable. It has been demonstrated, for example, that unselected college students tend to associate consistently certain musical selections both with designated mood-names and with particular colors (4). When the subjects are independently "asked to name the color best fitting the same mood-words, the results are very similar to those obtained with music" (4, p. 172). It appears likely, therefore, that associations between particular hues and musical configurations are formed indirectly on the basis of parallel relationships to specified moods.

In accordance with this point of view, music-mood and color-mood equivalences would in each case be arbitrarily determined by cultural convention. Music-color associations would then be uniformly acquired within a culture as a result of frequent separate experiences of a given hue and a given type of musical expression with the same mood. After a sufficient number of conventionalized experiences of this nature, the presentation of either the color or the music would arouse an emotional state which, in turn, would evoke other images or symbols consistently associated with it. The uniform acquisition of particular music-color linkages on this indirect basis would be enhanced by the relative invariability of the cultural stylization, by the vividness of the mediating mood states, and by the mutual reinforcement provided by the different mood-producing qualities of music such as pitch, timbre, key, rhythm and tempo.

This interpretation does not fit the findings of the present study very well because by design the influence of cultural conditioning was held to a minimum. First, it is extremely doubtful whether elementary school children have been sufficiently exposed to color-mood and music-mood conventions to acquire in each case the characteristic culturally conditioned associations. Second, pure tone frequencies (in contrast to musical selections) are not conventionally used by themselves to symbolize particular moods, arouse less vivid emotional states, and are not reinforced by other mood-generating cues found in music. It is true, however, that high- and low-pitched notes in music are conventionally used in combination with other elements to represent contrasting moods; and the fact that in a musical context they tend to be consistently associated by college students with light and dark hues respectively (2) suggests that it is possible for experienced individuals to respond to pitch alone with the mood ordinarily evoked by the entire mood-producing musical complex of which it is a part. Argelander's adult subjects, as a matter of fact, made these very same hue-pitch associations in matching colors with pure tone frequencies (1). But the acquisition of learned, culturally conditioned associations between isolated tones and particular moods on the basis of such a mechanism presupposes considerably greater musical experience than is presumably characteristic of elementary school children.

3. A third interpretation, most consistent with our finding of selective pitch-color associations in children, is that particular hues and pure tone frequencies are associated with each other because of a certain inherent "belongingness" between each member of a given pair and a particular mood (4). Thus, for example, if on the basis of some complexly mediated genetic predisposition, yellow hues and high frequency tones were each perceived as selectively compatible with joyous moods, a cross-modality association would develop between them in the absence of specific cultural conditioning. Experiencing either the hue or tone would suggest a joyous mood which, in turn would evoke a sensation, image, or judgment of compatibility referable to the other modality.

If such inherent predispositions existed with respect to color-mood and pitch-mood symbolizations, corresponding cultural conventions would not be wholly arbitrary, but would in part be based upon them. At this point, the entire cycle of events described under the second interpretation above would be set in motion. Thus, in the enculturated adult specific color-pitch associations would be both genetically and culturally determined; whereas in the less culturally sophisticated child genetic determinants might be considered relatively more crucial.

For this latter interpretation of our results to be substantiated, the following additional, but presently unavailable empirical evidence would be required: First, it would have to be demonstrated that children everywhere *actually do* associate colors and pure tone frequencies with moods. Second, cross-cultural comparisons would have to show significantly greater than chance uniformity with respect to (*a*) children's *particular* pitch-hue associations and (*b*) cultural symbolization of mood in relation to *particular* tones and colors.

E. SUMMARY AND CONCLUSIONS

Nine hundred ninety-five elementary school children in grades three through six were asked to indicate which of six spectral colors they "thought of" immediately following the administration of each of six pure tone frequencies (125, 250, 1,000, 4,000, 8,000, and 12,000 c.p.s.). Definite pitch-hue associations were exhibited which in general conform to results reported for adult subjects. *Yellow* and *green* were predominantly chosen following higher tone frequencies. The preponderance of *red* and *orange* selections occurred in relation to middle-pitched tones. Blue and violet were selected most in response to the lower sound frequencies. Percentages of yellow and blue selections when plotted against c.p.s. produced almost identical figures except that one was the inverse of the other. The same was true for red and violet. Color-tone associations were not significantly or consistently related to sex or variations in sound intensity.

The finding of definite pitch-hue associations in children, apart from a musical context, is interpreted as lending support to the view (*a*) that genetically determined predispositions exist for particular tones and hues to be perceived as selectively compatible with particular mood-states, and (*b*) that as a result of parallel relationships to such mood-states, particular colors and tones become indirectly related to each other. Cultural conventions with respect to color-mood and pitch-mood concomitance are regarded as determined in part by these predispositions and as secondarily reinforcing them in enculturated individuals. This interpretation, however, can only be confirmed by finding cross-cultural uniformities in children's associations of colors with pure tone frequencies.

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The Journal of Genetic Psychology, 1956, **89**, 105-117.

SEX-RÔLE LEARNING OF FIVE-YEAR-OLDS*

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A. Introduction

In current sociological and psychological literature the words "sex rôle" are frequently found as a convenient and inclusive term meaning the modal masculine personality and the modal feminine personality. This study is an attempt to measure two aspects of the child's perceptual world in regard to sex rôles: (*a*) his self-perception in terms of complying with the appropriate sex rôle, and (*b*) his perception of parental delineation of his sex rôle. The relevant research tends to fall into the following categories which give rise to the specific hypotheses of this study.

B. History of the Problem

1. *Social Rôles*

The term "social rôles" has evolved from the work of Linton (19), Kluckhohn and Murray (18), Parsons (23), Seward (26), and others who have advocated the adoption of the concept of the personality as being unique to a specific culture or sub-cultural group. Some writers (8, 20, 23, 24), working within this framework, have preferred to explain certain personality configurations in terms of rôles which are learned from the transmitters of culture (usually the parents). These same writers place emphasis upon the importance of the sex rôle.

2. *Parent-Child Relations*

The parent's relationship with the child has been emphasized by Johnson (17), who has described the family as providing the most vital relationships for any individual. Harsh and Schrickel (15, p. 113) state that the parent-child relationship of the preschool years are currently viewed as the most potent forces in personality development.

3. *The Sex Rôles*

The specific task of attaining the societally defined appropriate sex rôle is commonly described as a learning process (2, 7, 8, 13, 20, 21, 23, 24, 26).

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*Accepted for publication by Arthur T. Jersild of the Editorial Board, and received in the Editorial Office on February 10, 1955.

Although the terms for describing this process vary from one school of thought to another, there is agreement on the point that the parents contribute in a major fashion to the ease and accuracy with which the child learns the proper societal rôle. Cavan (7), Cottrell (8), L. Murphy (22), and Rabban (24) prefer to explain the learning process in terms of identification, with the like-sex parent usually the object of this identification. G. Murphy (20) and Seward (26), however, postulate only that learning occurs as the child performs within assigned limitations. Sears, Pintler, and Sears (25), Ferguson (13), and Parsons (23) advance the hypothesis that the adults, and particularly the like-sex parent, with whom the child comes into contact serve as models whom the child imitates. Rabban (24) and Sears, Pintler, and Sears (25) nevertheless recognize the possibility that one of the parents might create a more permissive environment for the child's exploration and adoption of his (the parent's) perception of the sexually appropriate behavior.

Specifically, parents report that they direct the child to their perceptions of the appropriate rôle for the child, rather than directing the child toward behavior appropriate for the parent but inappropriate for the child (24). Because of the possibility of perceptual errors, it is felt by these writers that there will be closer agreement between the child's behavior and the like-sex parent's direction than between the child's behavior and the direction of the parent of the opposite sex.

4. *Class Differences in Rôle-Learning*

Among those concerned with class differences in sex rôles, Rabban (24) and Cottrell (8) conclude that the lack of clear definition of adult rôles found in the middle class is reflected in the inability of the child of this group to discriminate the rôle which is appropriate for his sex, and to adapt his behavior accordingly. Rabban (24) found that middle-class children demonstrated confusion regarding sexually appropriate activities at a period subsequent to the age at which the lower-class children consistently chose appropriate activities. However, it is possible that when a criterion more meaningful to the child is employed, middle-class children of both sexes may choose sex-appropriate activities rather than sex-inappropriate activities.

5. *Family Size and Ordinal Position*

The only child, whose relations within the family are limited to adults, receives more parental supervision and guidance and is parentally directed to adult activities and interests at an age earlier than the child with older siblings (4, p. 104). Furthermore, the only child's competitive field is limited within the family to adults, and the only child is the sole object of parental aspirations (4, p. 103 f.). All these factors are seen as tending to motivate the only child toward early adoption of the adult rôles, including the adult sex rôle, and to result in close agreement between the child's attitude and his parent's attitude regarding sexually appropriate behavior.

Fenichel (12, p. 92 f.), Strauss (28), and Winkley (30) have focussed attention on the similarities existing in the behavior of the only child and of the oldest child in a family of two or more children, insofar as the oldest child is the only child in the family before the birth of a sibling. The similarities in behavior have been explained in terms of the parent's lack of experience with children (1, 3, 10, 14, 30). Havighurst and Davis present a supplement to this portrayal of the rôle of the oldest child in a family in their report that middle-class values are reflected in the assumption of responsibility for younger children by the oldest child in a family of this social stratum (9). Strauss (28) becomes even more explicit in describing the sibling relation by concluding that this expectation is met by the first born's attempt to teach and to dominate younger siblings. The younger child's learning situation would include not only the example and direction of the parent, but also the example and direction of the older sibling. As a consequence, it would appear that the younger sibling might be expected to learn the appropriate sex rôle more quickly and accurately than the only child.

C. THE PROBLEM

Research to date concerned with the learning of sex rôles has been directed to the child's overt behavior and his verbalized preferences regarding play materials (e.g., 5, 16, 24, 25). Rabban studied parents' accounts of the means by which they indoctrinated the child into a sex rôle (24). Generally, the research has been little concerned with the child's perception of the processes by which he learns sex-appropriate behavior.

The hypotheses enumerated below relate to the child's perception of the rôle of the parents, who are the primary socializing agents in the American middle-class group, and upon the educational rôle of the older siblings. The study was planned with the acceptance of Cass' conclusion (6) that although the child's perception may not correspond in fact with parental behavior, his perception is probably more important in the sense that it is a part of his effective psychological environment.

Assuming that the choice of play materials is a reflection of the self-concept of sex rôle when the play materials are categorized as *masculine* and *feminine*, the following hypotheses concerning five-year-old children are tested.

Hypothesis I. Boys tend to choose masculine activities significantly more often than girls choose masculine activities; girls tend to choose feminine activities significantly more often than do boys.

Hypothesis II. Children with an older like-sex sibling tend to choose sexually appropriate play materials significantly more often than children without an older like-sex sibling.

Hypothesis III. Boys tend to perceive both parents as preferring masculine activities significantly more often than girls perceive their parents as preferring masculine activities for the child.

Hypothesis IV. Children without an older like-sex sibling tend to perceive their parents as preferring sex-appropriate activities more often than children with an older like-sex sibling.

Hypothesis V. The choices of play materials made by children without older like-sex siblings agree more closely with the perceived paternal preferences than the choices of children with an older like-sex sibling agree with perceived paternal preferences.

Hypothesis VI. The choices of play materials made by children without older like-sex siblings agree more closely with the perceived maternal preferences than the choices of children with an older like-sex sibling agree with perceived maternal preferences.

Hypothesis VII. Boys' choices of play materials agree more closely with perceived paternal preferences than girls' choices of play materials agree with perceived paternal preferences.

Hypothesis VIII. Girls' choices of play materials agree more closely with perceived maternal preferences than boys' choices of play materials agree with perceived maternal preferences.

D. SUBJECTS

The subjects participating in the study included 20 boys and 18 girls whose birthdates were between January 1, 1948, and January 1, 1949. At the time of the study all the subjects were between four years nine months and five years nine months of age. Ten subjects of each sex were only children; 10 boys had one or more older brothers; and eight girls had one or more older sisters. Only eight girls eligible for this last category were located. None of the subjects with an older like-sex sibling had an older sibling of the opposite sex.

All children were enrolled in a nursery school or kindergarten in Leon

County, Florida, or were enrolled in a large Sunday school class in Tallahassee (Leon County), Florida. Each child lived in the home with the mother and father in every case but two; in these two cases the natural father was in military service and the grandfather was assuming the paternal rôle. All families were considered middle class by virtue of the father's occupation.

The siblings of children included in the study were in the home during the course of the study and had been born subsequent to January 1, 1944. Thus each older like-sex sibling was less than 10 years of age.

E. Procedure

1. *Development of Materials*

Six pictures on three themes were developed by preliminary work with 20 three- and four-year-old boys and girls. These children responded to a variety of action pictures of children in regard to the sexual appropriateness of activities for the adult male and female, and for boys and girls. The three activities showing the greatest differences regarding sexual appropriateness were then used as themes for the paired pictures which include three female-appropriate activities and three male-appropriate activities. Each picture included a relatively ambiguous adult female figure and a relatively ambiguous adult male figure.

2. *Presentation of Materials*

To facilitate the establishment of rapport and to prepare the subjects for subsequent choice situations, one pair of pictures of puppies was presented to each child. The experimenter described the activity in which each animal was engaged and then asked the child to give other information concerning the puppies. The child was asked to designate the activity preferred by the puppy, and finally was questioned regarding his own preference for the activities depicted.

Six pictures 8½ by 11 inches were paired in order to present to the child three pairs of pictures, each consisting of a sex-appropriate activity and a sex-inappropriate activity. Two sets of the six pictures were prepared, with the theme centered on a male child in one series and on a female child in the other; each picture also included the adult male figure and the adult female figure mentioned above.

Theme I. This pair of pictures was concerned with play activities. The male-appropriate activity was baseball and doll play was pictured as the female-appropriate play material, in accord with the results of the criterion established by the earlier research. Baseball would then be sex-inappropriate for the female and dolls, sex-inappropriate for the male.

As the first pair of pictures was presented, the examiner said:

> This boy (or girl) is going to play baseball. You see, he has his bat in his hand, and he's wearing his baseball cap and glove. His mother and daddy are watching him as he goes to play. Then she said: Here is the boy (or girl) playing with a doll. He is holding the doll in his arm and looking at it. And here are his mother and daddy watching him.

While both pictures were before the child, the examiner asked the following questions:

> Which of these do you do? Which do you like to do best?
> Which does Mother want the boy to do?
> Which does Daddy want the boy to do?

Theme II. These pictures also involved play materials; the male-appropriate activity was playing with toy cars and trucks, and the female-appropriate activity was cooking. The earlier research showed that children near the age of these subjects often expressed preference for cooking, but stated that there was parental objection to this activity because of the potential injury to the child. For this reason, the female-appropriate activity was described as *play-cooking* or *playing cooking.*

When the paired pictures were presented, the child was told:

> This boy (or girl) is playing with his toy trucks. You see, he has a truck in each hand. And his mother and daddy are watching him as he plays. Here the boy (or girl) is playing cooking. He has a bowl and a spoon. His mother and daddy are watching him as he plays cooking.

The child was again asked the questions regarding his own choice of activity, the mother's preference, and the father's preference.

Theme III. The earlier research with preschool children showed that the most highly differentiated adult activities were centered around the home, where the mother was perceived as working inside the house, as sweeping, mopping, dusting, washing dishes, etc., and the father was perceived as being active outside the house. He was described as working in the garden, raking, mowing the lawn, working in the garage, etc. In view of this distinction, sweeping was chosen as the female-appropriate activity and raking was used as the male-appropriate task in the third pair of pictures.

As the examiner presented the paired pictures, she said:

> This boy (or girl) is raking the yard. You see, he has his rake right here in his hands. His mother and daddy are watching him as he rakes. The boy (or girl) is sweeping the house with this broom he is holding. And here are his mother and daddy watching him as he sweeps.

While both pictures were in full view, the child again was asked to designate his own choice of activity, his perception of the mother's preference, and his perception of the father's preference.

When the subject was a girl, a similar series of pictures with a little girl as the central figure was used; identical questions were asked. The position of the pictures of the male-appropriate activities and female-appropriate activities was altered from left to right from subject to subject. In addition, questions concerning perceived paternal and perceived maternal preferences were alternated in order of presentation.

The children's responses were recorded verbatim during the picture interview. These responses were then examined in testing the several hypotheses of the study.

3. *Scoring*

Each child's responses for Theme I, Theme II, and Theme III were tabulated in the following manners.

a. Masculine-feminine scores. Regardless of the sex of the child, each choice for an activity was scored "masculine" if it agreed with the criterion of masculinity upon which the pictures were based; if the choice agreed with the criterion of feminine activities, it was scored accordingly. Each child's perception of paternal preferences and his perception of maternal preferences for the activities in each theme were recorded as masculine or feminine in the same manner. The raw frequency scores for the child's masculine-feminine choices and the frequency scores for his perceptions of maternal and paternal masculine-feminine preferences were then used in the analysis.

b. Appropriate-inappropriate scores. The child's responses regarding his choice of masculine-feminine activities for each theme were tabulated in accordance with the criterion of sex-appropriateness and sex-inappropriateness. Frequency tallies were made of children's sex-appropriate and sex-inappropriate choices on each of the paired pictures. The subject's perceptions of maternal and paternal preferences for sex-appropriate and sex-inappropriate activities were scored in the same manner.

c. Parent-child agreement scores. In order to determine the extent to which agreement existed between the child's choices of a specific activity and his perception of a parent's preference, the responses tabulated as masculine-feminine scores were used. If the child's choice and his perception of the parent's preference were the same, regardless of the appropriateness or inappropriateness of the chosen activity, the concurrence was scored as an agreement.

F. Results

Insofar as the comparisons of the responses of differing groups were made, the basic *t* formula (11, p. 151) was used in measuring the reliability of the difference between the means of the groups under scrutiny. The results are shown in Table 1.

TABLE 1

Measures of Significance of the Differences between the Means Obtained From the Comparison of Children's Responses

Hypothesis	Group	$\bar{X}$	N	t	p
I	Boys	2.35	20		
	Girls	0.83	18	6.07	<.01
II	Only children	2.35	20		
	Children with siblings	2.22	18	4.99	<.01
III	Boys	3.95	20		
	Girls	2.22	18	2.80	<.01
IV	Only children	3.85	20		
	Children with siblings	3.33	18	1.09	>.05
V	Only children	1.90	20		
	Children with siblings	1.78	18	4.12	<.01
VI	Only children	2.05	20		
	Children with siblings	1.72	18	1.11	>.05
VII	Boys	2.10	20		
	Girls	1.56	18	1.97	>.05
VIII	Boys	1.95	20		
	Girls	1.83	18	0.38	>.05

a. Hypothesis I. The *t*-ratio of 6.07 ($p = <.01$) indicates a significant difference between the boys' choices of masculine play materials and girls' choices of masculine play materials, thus rendering the first hypothesis tenable. Inasmuch as the two categories *masculine* and *feminine* are mutually exclusive, it can be concluded that girls tend to choose feminine activities more often than do boys. Within the range of behavior examined in this study, it is apparent that these five-year-olds manifested a clear identification with the appropriate sex rôle. This is in contrast to Rabban's observation (24) that the middle-class children generally have not achieved a clarification of sex rôles at the age of five years. Perhaps these data differ from Rabban's because a more meaningful criterion for the child was used for his demonstration of ability to choose sex-appropriate activities.

b. Hypothesis II. In testing this hypothesis, the data reveal that only children more often choose sexually appropriate activities than do children with one or more older like-sex siblings ($t = 4.99$; $p = <.01$). This is contrary to the hypothesis, which was based on the assumption that older siblings aid in teaching the child his sex rôle. It may be speculated: (*a*) that older siblings have no influence on the younger child's learning of sexually appropriate behavior, or (*b*) that the greater permissiveness in the relationship between the parents and the younger child (as compared with the only child) counterbalances the teacher-pupil relationship between older and younger siblings.

c. Hypothesis III. The hypothesis that the child perceives his parents as preferring sexually appropriate activities is supported by the data ($t = 2.80$; $p = <.01$). Because of the complementary but mutually exclusive relationship existing between the criterion of masculinity and the criterion of femininity, it can be concluded that girls perceive both parents as preferring feminine activities for girls while boys tend to perceive both parents as preferring masculine activities for boys.

These data indicate that within the perceptual world of five-year-olds, parents appear to have clear preferences regarding sexually appropriate modes of behavior for their children. Not unjustified, then, would be the conclusion that these children's apparent clarification of sex rôle is related in a positive manner to their perceptions of both parents as generally preferring activities appropriate to the child's sex group. The general question regarding whether or not parents teach sex rôles may be answered with the statement that the child perceives his parents as establishing limits of expectation concerning behavior for the child's sex group.

d. Hypothesis IV. The testing of this hypothesis reveals that the only child's perception of parents' preferences for sex-appropriate play materials for the child and the perception of the child with siblings do not differ significantly ($t = 1.09$; $p = >.05$). Both groups of children appear to perceive their parents' clear preferences for sex-appropriate activities, and yet the testing of Hypothesis II revealed that only children more frequently chose appropriate activities. These findings lead to speculation regarding increased parental permissiveness with second and younger children, as reported by some writers (1, 3, 14, 28). It would appear that these subjects do not perceive the reported differences in parental permissiveness.

e. Hypothesis V. This hypothesis gains support as analysis of the data reveals that only children's choices tend to agree more often with their perceptions of paternal preferences than do the choices of children with siblings ($t = 4.12$; $p = <.01$). This finding may indicate that the older siblings' teachings are not entirely consistent with the parents' guidance, that the only children are closer to the father than are children with siblings, and that the father is more nearly a companion and friend to only children; or, it may reflect the effect of the older siblings' teaching combined with the fathers' increased permissiveness with the younger children.

f. Hypothesis VI. This hypothesis, to the effect that the agreement is closer between the only child's choices and his perception of his mother's preferences than the agreement between the choices of the child with siblings and his perception of his mother's preferences, is rejected ($t = 1.11$; $p = >.05$). The factor influential in the rejection of this hypothesis may be tentatively identified as the father's relatively singular parental rôle as playmate to the child, as contrasted with the mother's dual rôle of caring for the child's physical and emotional needs in addition to her disciplinary rôle. This difference in parental rôles has been described by Cavan (7, p. 157).

g. Hypothesis VII. This hypothesis, regarding the agreement between boys' choices and perceived paternal preferences, is also rejected ($t = 1.97$; $p = >.05$). However, there is a suggestion that a closer agreement exists between boys' choices and perceived fathers' preferences. Nevertheless the reason for this apparent tendency has not been isolated. It may be related to the father's rôle as playmate (7, p. 157), or it may be related to the greater clarity with which the masculine rôle is defined (7, p. 148 f. and p. 155) and to the psychoanalytic concept of identification (12, pp. 88-91).

h. Hypothesis VIII. The hypothesis that girls' choices agree more closely with perceived maternal preferences than boys' choices agree with perceived maternal preferences is also rejected ($t = 0.38$; $p = >.05$). This rejection may be an index of the adult female's lack of clear definition of a sex rôle for herself (7, p. 144; 24; 29, p. 60) and the resulting lack of clear definition of a sex rôle for the female child.

The above findings indicate that these five-year-old, middle-class children of both sexes have clearly identified with the appropriate sex rôle. Whether or not the child has an older like-sex sibling is found not to be an important factor in relation to the child's perceptions of appropriate parental choices of play materials. However, this factor does appear to be significant in the closeness of the relationship with the father. It seems relatively clear that these children perceive their parents as indoctrinating them into the appropriate sex rôle. This finding is gratifying in view of the fact that the area of sex-rôle adjustment appears to be of significance because the sex rôle is a basic pattern of life assigned by society and lived day by day. The child's sex-rôle adjustment in progressively attaining maturity and his assumption of adult responsibilities in the community and in the family are dependent upon his adjustment in childhood.

G. SUMMARY

This study was designed to measure the five-year-old child's self-concept in regard to sex rôles and his perception of parental definition of his appropriate sex rôle. A picture interview technique was employed.

Middle-class children ranging in age from four years and nine months to five years and nine months served as subjects. Thirty-eight children whose parents live in Leon County, Florida, were chosen. Ten children of each sex were only children; 10 boys had one or more older brothers less than 10 years of age; and eight girls had one or more older sisters less than 10 years of age. None of the children with an older like-sex sibling had an older sibling of the opposite sex.

The subjects were individually presented three sets of paired pictures in which a child and two parents were depicted; each pair showed a child involved in one masculine play activity and in one contrasting feminine play activity. The children's responses concerning their choices of activities and their perceptions of parental preferences for the activities were recorded verbatim. Statistical analyses, *t*-ratios on differences between means, were made of these data. The results were:

1. Boys tend to choose masculine activities more often than do girls ($t = 6.07$; $p = <.01$).
2. Only children choose sex-appropriate activities more often than do children with older like-sex siblings ($t = 4.99$; $p = <.01$).
3. Children of both sex groups perceive the parents as preferring the activities appropriate for the child's sex more often than preferring sex-inappropriate activities for the child ($t = 2.80$; $p = <.01$).
4. There is no difference between the frequency with which children with older like-sex siblings perceive parents as preferring sex-appropriate activities for the child and the frequency with which only children perceive parents as preferring sex-appropriate activities ($t = 1.09$; $p = >.05$).
5. Only children's choices of play activities, regardless of the appropriate-

ness of the activities, show closer agreement with their perception of paternal preferences than occurs between the choices of children with siblings and their perceived paternal preferences ($t = 4.12$; $p = <.01$).

6. The agreement between choices of play materials made by children without siblings and their perceived maternal preferences appear to be no closer than the agreement between choices made by children with siblings and their perceived maternal preferences ($t = 1.11$; $p = >.05$).
7. Boys' choices of play materials appear to agree more closely with the perceived paternal preferences than girls' choices of play materials agree with perceived paternal preferences ($t = 1.97$; $p = >.05$).
8. Girls' choices of play materials show no closer agreement with perceived maternal preferences than occurs between boys' choices and their perceived maternal preferences ($t = 0.38$; $p = >.05$).

The implications of these findings are discussed in relation to current theories regarding inter-family relations and sex rôle learning.

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The Journal of Genetic Psychology, 1956, **89**, 119-125.

SPONTANEOUS RECOVERY OF AN AVOIDANCE RESPONSE OVER AN EXTENDED TIME INTERVAL IN THE MONKEY*

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A. Introduction

In the course of extensive work with avoidance conditioning in the rhesus monkey, surprising amounts of spontaneous recovery have been observed after extended time intervals. Avoidance responses have been observed to recover spontaneously to conditioning criterion levels after an interval of more than one year. Although the phenomenon of spontaneous recovery has been recognized for many years, very little data has been collected on the topic. As indicated by Underwood, ". . . of the scores of studies which have taken extinction measures, very few have gone ahead to gather data on spontaneous recovery" (13, p. 45). He suggests that this lack of information concerning the parameters of spontaneous recovery has markedly hindered the evaluation of theories of extinction.

As a rule, studies on spontaneous recovery have been restricted to extremely short time intervals. Past studies have investigated recovery after one minute (9), 3 to 10 minutes (5), one hour (8), and 48 hours (11). These figures represent the typical range of time intervals commonly employed in this area of investigation. A noteworthy exception was the demonstration by Estes (3) of measurable amounts of spontaneous recovery in rats after a 40-day interval.

The present study was undertaken to determine the amount of spontaneous recovery of an avoidance conditioned response over an extended time interval. Two hundred and five days were arbitrarily selected as the interval between the original extinction and the test for spontaneous recovery.

B. Method and Procedure

1. *Subjects*

The subjects were eight young Macaque mullata monkeys (No. 62, 71, 72, 74, 75, 76, 78, 81) varying in weight from 8 to 14 lbs. Seven of the animals were male and the other (No. 78) was a female.

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*Received in the Editorial Office on February 21, 1955.

[1] This investigation was supported in part by a grant (No. M-487C) from the National Institute of Mental Health, Public Health Service.

[2] The authors are indebted to Dr. I. Arthur Mirsky for suggestions and criticisms.

2. *Apparatus*

The conditioning box was 18″ wide, 22″ long, and 28″ high. The floor consisted of stainless steel bars through which an electric shock could be given to the animal. A one-way mirror made observation possible. On one side, 19 inches from the grid, a one-half by three-quarter inch bar protruded one-quarter inch from the side of the apparatus. A microswitch terminated the conditioned stimulus and the unconditioned stimulus when the bar-pressing response occurred. Each bar-pressing response was recorded on an automatic electric counter. Two 40-watt red lights were located above the frosted glass which formed the top of the animal compartment. A 20-watt flourescent light, also above the frosted glass, provided the constant source of illumination.

The shock apparatus, although of independent design, was identical in principle to that described by Skinner (12). The apparatus is unique in that it eliminates the possibility of avoiding shock due to faeces on the grid, standing on alternate bars, etc.

Animals 71, 72, 75, and 78 were a part of the experimental group of a preconditioning study. These animals were given 200 presentations of a red-light and a 1,000-cycle tone before conditioning was undertaken. The remaining animals were given comparable amounts of time in the apparatus with no stimuli presented. After this preliminary experience, all animals were conditioned to the red light stimulus. After a five-minute adaptation period, 15 conditioning trials were given to the animal. These were presented at irregular intervals with an average of 67 seconds. The red-light conditioned stimulus was presented alone for two seconds. After this interval the shock unconditioned stimulus was presented unless the animal responded appropriately to the conditioned stimulus. Both stimuli continued until the animal made the bar-pressing response which terminated the stimuli. The criterion of conditioning was arbitrarily set at the 90 per cent level of response for two successive days, i.e., 27 responses in 30 trials.

After the animals attained the criterion, the so-called critical test trials for preconditioning were undertaken, i.e., an unreinforced 1,000-cycle tone was presented for two seconds. After the animals failed to respond to the tone at or above the 10 per cent level for 30 trials, additional non-reinforced trials were given to the two-second red light stimulus until the same criterion was attained. During the interval following extinction, these animals were subjects in a discrimination study in the Wisconsin General Test Apparatus. After a total of 205 days since attaining the extinction criterion in the conditioning box, these animals were tested for spontaneous recovery to the red-light stimulus used in original conditioning.

C. RESULTS

The preconditioning study (4) employed additional animals to those used in the present study. A comparison of the animals used in the study described herein showed no significant effect which might be attributed to the preconditioning variable, consequently these data have been pooled in the assessment of spontaneous recovery. The untreated data are presented in Table 1.

TABLE 1
CONDITIONAL RESPONSES IN THE LAST THREE DAYS OF ORIGINAL EXTINCTION AND IN THE TESTS FOR SPONTANEOUS RECOVERY

Animal	71	72	75	78	62	74	76	81
				Extinction				
Test period								
3	5	5	5	4	4	8	7	9
2	3	0	1	1	0	1	2	1
1	0	0	0	0	0	0	1	1
				Spontaneous recovery				
1	9	15	0	13	1	7	15	3
2	6	14	0	14	0	3	15	2
3	4	14		15		0	13	0
4	3	9		9			12	
5	0	11		5			9	
6		4		0			3	
7		1		0			0	
8		2						

The data for the last three days of extinction and the first two days of spontaneous recovery are shown in Figure 1. The percentage frequency of conditional responses for the first two days on spontaneous recovery is 49 as compared with a percentage frequency of 4 on the last two days of extinction. These data have not been subjected to the customary statistical analysis due to the arbitrary restriction imposed by the extinction criterion.

The present study was designed to demonstrate the occurrence of spontaneous recovery in sufficient quantities to provide a supplemental behavioral measure for future studies. In such an application the comparison would be between the amount of spontaneous recovery for more than one group. In this case the statistical appraisal would be completed with the usual techniques.

D. Discussion

The data summarized in Table 1 and presented graphically in Figure 1 clearly indicate the spontaneous recovery which occurred over the 205-day interval. The recovery is particularly striking in the case of Animals 72, 78, and 76 which recovered the previously extinguished response to the extent that the original conditioning criterion was attained.

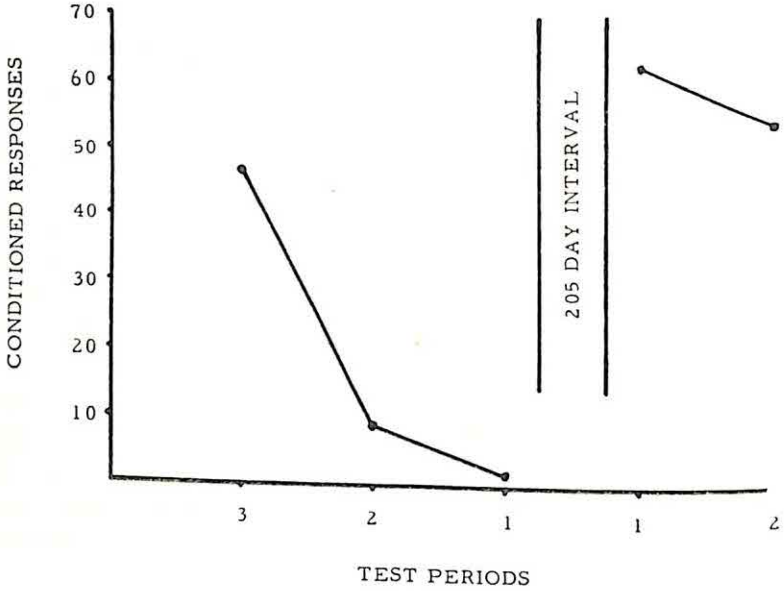

FIGURE 1
Conditioned Responses for the Last Three Test Periods of Extinction and the First Two Periods of Spontaneous Recovery

The spontaneous recovery of a response formerly established to a painful stimulus is of particular interest in relation to the rôle of fear postulated by numerous theoreticians to be important in avoidance conditioning. Unfortunately, Mowrer (10) did not come to grips with the problem of extinction and spontaneous recovery. He presented considerable evidence that fear is an important process in the acquisition of an avoidance response. In discussing extinction, Mowrer considered only the inhibition of overt behavior and completely abandoned the fear-reduction interpretation with the parenthetical comment that "How emotional reactions are negatively modified is an independent and, at present, not well understood problem" (10, p. 152). Although such factors as the fatigue discussed by Mowrer are undoubtedly important in the extinction process, the basic question from a fear-reduction viewpoint should logically be directed toward the extinction of the underlying fear process. If the response is learned and maintained by a fear-reduction mechanism, it appears operationally logical to assume that extinction of the overt response is an indication that the postulated fear is either (*a*) no longer present, or (*b*) is now reduced by responses other than the arbitrarily chosen conditional response. A suggestion as to the relative merits of the two alternatives is indicated by the technique of extinguishing a conditional response, arousing "fear" in a different situation with electric shock and immediately retesting the animal for the conditional response. Preliminary studies with rats suggest that the response is not reinstated with such a technique. This appears, at first glance, as a crucial weakness of a fear-reduction interpretation since the reinstatement of "fear" should result in a restitution of the response. It is possible, however, that during the period of extinction the animal learns to make responses other than the arbitrarily chosen conditional response. A fear-reduction theorist would postulate that the alternate responses are learned by fear reduction principles. Consequently, the arousal of "fear" before returning an animal to the original extinction situation would not result in a reinstatement of the original conditional response. In this case the reinforced response might be any of several responses other than the original response. This interpretation could easily account for the common observation that when one response is extinguished, other conditioned responses likewise undergo extinction, i.e., the responses of sitting, grooming, etc., would be expected to generalize extensively from one extinction situation to another.

It is reasonable to assume that an increase in overlearning is accompanied by increased retention. In the conditioning situation the response with high degrees of overlearning is the conditional response. Accordingly, the alternate responses learned during extinction are limited by the extinction criterion, i.e., as soon as the animal attains a 90 per cent level on one or more responses other than the conditional response the extinction is considered complete.

Spontaneous recovery from this point of view is attributable to the greater retention of the conditional response as compared with the alternate responses in which overlearning was minimal or non-existent. This is in accord with the observation that the amount of spontaneous recovery is reduced when extinction is continued beyond the extinction criterion (1). In this case the separation in degree of overlearning between conditioned responses and extinction responses is lessened and smaller amounts of spontaneous recovery would be expected. Liberman (7, 8) similarly suggests that spontaneous recovery is attributable to the "forgetting" of extinction. Differential forgetting of conditioning and extinction is attributed by Liberman to the imposed discrimination of the "appropriate" response in conditioning but not in extinction.

Although this hypothesis is an ingenious attempt to explain extinction on the basis of an interference theory of forgetting, the experimental demonstration is difficult to evaluate due to a change in criterion between conditioning and extinction; a 50 per cent reduction in intertrial intervals in extinction; and a trial by trial analysis of spontaneous recovery. These factors make it difficult to assess the amount and importance of the spontaneous recovery obtained.

Although, as Liberman suggests, the absence of a specific response during extinction is important in the process of spontaneous recovery, a more significant factor in determining spontaneous recovery may be the high degree of overlearning on the conditional response along with minimal learning of the responses made during extinction.

It is of some interest to consider the implications of the study described herein for conditioning studies which employ a reconditioning procedure. These data indicate that the time interval between conditioning and reconditioning is a crucial variable in determining the course of conditioning and extinction of the re-established response. Comparisons of original conditional responses and re-established responses appear particularly hazardous until more is known of the parameters of spontaneous recovery.

Although the phenomenon of stimulus generalization has been extensively investigated in conditioning (6), it is noteworthy that no studies have been reported on the generalization characteristics of a spontaneously recovered response. It may well be that generalization is more extensive in the recovered response than in the original conditioned response. This is apparent when it is recognized that the experience with the original stimulus may be separated by an extended time interval from the generalization test stimuli.

Although no studies have been reported on spontaneous recovery over anything comparable to the time interval of the study described herein, it is possible that the phenomenon is attributable to the phylogenetic disparity between the monkey and the usual laboratory animal.

The area of spontaneous recovery appears particularly fruitful in terms of experimental methodology. It is possible with a relatively minimal expenditure of effort to add an additional dependent variable to studies involving the conditioning procedure. Although the phenomenon has not been sufficiently investigated to justify the use of spontaneous recovery as the main dependent variable, it does appear to have considerable value as a supplementary behavioral measure.

E. Summary

Eight rhesus monkeys were tested for the spontaneous recovery of an avoidance conditioned response which had been extinguished 205 days previous to the recovery test. The response was observed to recover markedly with three animals attaining the original criterion of conditioning. The theoretical and practical implications of parametric studies in this area were discussed.

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The Journal of Genetic Psychology, 1956, **89**, 127-130.

THE GEOTROPIC REACTION OF NEWBORN PUPPIES*

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A. PROBLEM

Previous articles have described movement patterns of newborn puppies which keep the animals together and in contact with the mother. In the first of these studies the puppies were born on a whelping board mounted on springs in order to observe the affect of vibration on the behavior of the newborn animals. When the animals and mother were on one side of the whelping board, the floor of the board had an upward incline, and it was evident that this incline had some influence on the movements of the puppies. For this reason analyses of the movement patterns were made on a level whelping board, with plans to analyze the relationship between angle of incline and movement patterns in a later study. This paper deals with this aspect of puppy behavior, and attempts to answer two questions: What angle of inclination will affect the orientation of newborn puppies, and what is the response pattern to the incline?

B. APPARATUS AND PROCEDURE

Preliminary observations were made on 17 puppies during the Summer of 1953. In these observations a satisfactory method was devised for measuring the movement of the puppies on the incline, and the smallest inclination was determined which would influence the movement patterns. The plan of the apparatus is shown in Figure 1.

An 18-inch square piece of ¼ inch plywood was mounted so the angle of inclination could be varied. Recorders were placed at four points around the incline to measure the movement of the animal in various directions. The strings to Recorders 2, 3, and 4 were tied together and fastened to a rubber band which could be placed around either the neck or hips of the puppy, depending on which end of the body was downhill. Recorder 1 was fastened to a rubber band which could be placed around the part of the body which was in an uphill direction.

Since the interest in the present study was in the form of orientation which appears at birth and the variations in the pattern as the animal ma-

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*Received in the Editorial Office on March 9, 1955.

tures, it would seem to be adequate to give samples of the type of data obtained in the observations and describe the change in the orientation patterns with age.

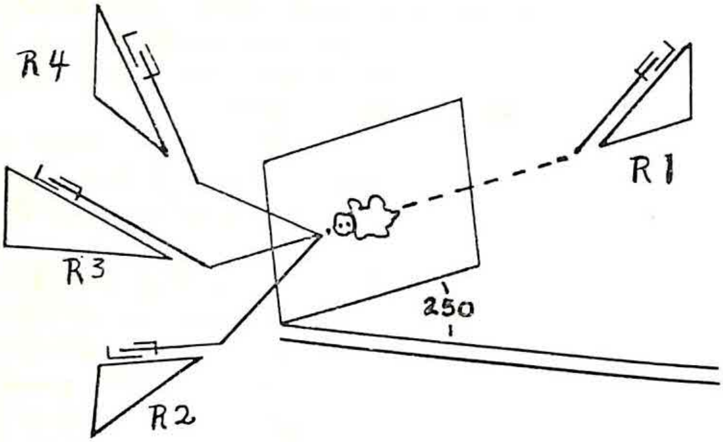

FIGURE 1

C. RESULTS

The smallest angle of inclination which elicited an orientation response was 25 degrees in all animals. Recorder 1 was attached to the part of the body uphill. If the animal was placed on the board with head downhill, the animal would swing the head either right or left, then drop the rear end downward. This form of movement gave records comparable to those shown in the first 5 lines of Table 1, obtained on Animal 86 at four days of age. As observed from the table, this form of movement gave a greater reading on Recorder 1. The readings of the other three recorders were

TABLE 1

Position of head	Rec. 1	Rec. 2	Rec. 3	Rec. 4	Direction of turn
Head down	207	90	135	93	Rt. 180
Head down	235	78	115	85	Rt. 180
Head down	230	112	170	89	Rt. 180
Head down	205	185	198	167	Rt. 180
Head down	180	92	100	75	Lt. 180
		25 Days of Age			
Head down	75	419	470	357	Rt. 180
Head down	23	198	210	145	Rt. 180
Head down	93	390	451	443	Rt. 180

due to shift of the head and body during the turn. This form of rotation to an uphill position has been observed as early as one day of age. When the animal is placed on the incline at this early age with head uphill it does not attempt to turn, but either remains quiet or tries to pull upward. At this age, however, the animals are not strong enough to do so. If placed on the board with head downward, however, the animal always shows restlessness and whines until it is oriented uphill.

As the animals mature the movement pattern changes in the following manner: About the 17th day the puppies may propel backward rather than turn to face uphill, in any case the direction of the movement is upward. At 25 days of age the turn is produced by an active rotation of the body through 180 degrees, using the rear end as a pivot. This form of movement gives a record similar to that shown in the last three lines of Table 1. At this age, if the animal is placed on the board with head downward, it may walk directly to the bottom of the incline. Occasionally an animal of this age will walk to the top of the incline, but they always stop at the edge and pull back. In some cases the animals back upward to the top. In these cases as the rear end projects over the top edge, the puppies invariably pull back onto the board. There was not a single instance in which these young animals tipped over the top edge of the board.

D. SUMMARY

It is quite evident from observations on 21 puppies that the young animals have a strong tendency to orient upward on an incline of at least 25 degrees, and to pull upward as soon as they are strong enough. They are greatly disturbed by having the head in the downward position. This position elicits whining and restlessness until they become oriented upward. If the animals are placed on the board with head upward, however, they remain quiet and may go to sleep.

There was no attempt in the present experiment to determine the neural mechanisms responsible for the orientation behaviors. On the basis of the observed behavior, and what is known about the neurology of orientation patterns in general, the present observations suggest that both the vestibular systems and kinaesthetic systems of the proprioceptive-cerebellar mechanisms function at this early age in puppies.

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Department of Psychology
University of Georgia
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The Journal of Genetic Psychology, 1956, **89**, 131-138.

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The Journal of Genetic Psychology, 1956, **89**, 133-135.

(Edwards, A. L. Statistical Methods for the Behavioral Sciences. New York: Rinehart, 1954. Pp. 542.)

REVIEWED BY KURT SALZINGER

This is an important and useful textbook in the field of applied statistics for the student who lacks a background in algebra but who is interested in doing research in the behavioral sciences. More specifically, it would serve very well as a text in the first part of a graduate course in applied statistics.

Beginning with a chapter dealing with manipulation of fractions, decimals, proportions, positive and negative numbers, radicals, exponents, logarithms, and summation signs, Edwards successfully brings the reader through descriptive and inferential statistics up to three-part analysis of variance. This book, like others having the same purpose, covers measures of central tendency and variability, graphical representation of frequency distributions, standard scores and normalizing distributions, linear regression, the product moment correlation coefficient and other coefficients of association, the binomial distribution, the concept of probability, the normal distribution, tests of significance for measures of central tendency, and differences between such measures (for independent samples, for paired observations and equated groups, for correlation and regression coefficients, and differences between them), simple analysis of variance (two-part and three-part analysis of variance), the chi-square test for two or more categories, and finally contingency and phi coefficients.

In addition to this impressive list of topics, Edwards has managed to include a chapter dealing with non-parametric statistics. For some time now, non-parametric statistics has been presented either in such a complex form that the average behavioral scientist (how much more so the student) was unable to follow it, or in such strict cookbook fashion that the basis of the test was unclear. In contrast to this, Edwards has taken the rank analysis of variance and derived the final formula, which is usually presented without or with little explanation, from analysis of variance; moreover he was able to relate W, the coefficient of concordance, to its parametric equivalent, the correlation ratio. For those interested in using non-parametric statistics, we might indicate here the tests with which Edwards deals: the rank correlation coefficient, coefficient of concordance (degree of agreement between m sets of n ranks), analysis of variance of an $m \times n$ table (by ranks and by the median test), analysis of variance of ranks for a two-way classification, a rank test for the significance of difference of two or more independent groups, correction of the above tests for ties, and finally the sign test and rank test for paired observations. One can see here practically the whole range of problems that have so far been treated by using statistics based upon assumptions of normality of distribution, homogeneity of variance, linearity of regression, etc. At last, methods have been made readily available to the student for use on data that do not meet the assumptions mentioned above.

Before leaving the non-parametrics, we must note a discrepancy between Edwards' treatment of "0" differences both in the sign test and in the paired replicates test and between that suggested by the originators of the test. Edwards assigns half the differences to the positive side, half to the negative side, while the original tests discard those pairs of observations, reducing the sample size by those discarded pairs. As long as these "0" differences are small in number and the samples are not too small there is little difference between the two techniques; when the relative number of "0" differences increases, however, Edwards' method tends to give rise to a smaller Type I and larger Type II error than the original test did. At first glance Edwards' technique might be preferred since it sounds like the conservative one; upon further thought, however, one must become aware of the fact that Edwards' technique is the more conservative one only if the experimenter is interested in showing a difference; but if he wants to show no difference this no longer holds true. The real answer to this discrepancy might perhaps lie in the fact that when the relative number of "0" differences is small, it makes no difference which method is used (as mentioned above), while when it is large the tests cannot be used since strictly speaking the tests were designed for the case in which no ties in paired comparison occur.

Unfortunately Edwards decided not to include another simple non-parametric technique, the Kolmogorov-Smirnov test for comparing ordered distributions.

Returning to the parametric part of the book, special note should be taken of the many discussions in this book not usually treated in other books of its kind. Examples of this are: the derivation demonstrating the effects of random errors on various statistics such as the variance, covariance, and the mean; treatment of the problem of transforming such curves as the power, exponential, and logarithmic curves to linear ones; the derivation of the point biserial correlation, phi coefficient, and rank order correlation from the product moment correlation; the relationship between the binomial, normal, and chi-square distributions; the concepts of power of a test and of Type I and Type II errors, tests for linearity of regression, Tukey's procedure for comparing individual means after an analysis of variance, chi-square method for combining the significance levels of several independent tests, and finally 15 tables some of which like those for the testing of significance for comparing two independent treatments non-parametrically and for the significance of the coefficient of concordance are not readily available in other sources.

In conclusion, this reviewer can honestly state that he enjoyed examining this book not only because of its clarity, but also because it is a pleasure to follow the author's systematic method of a gradual almost imperceptible introduction to new and difficult concepts as well as to complete algebraic proofs. This book is recommended not only as a text but also as a reference book.

Linden Hill School
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(Manuscripts are printed in the order of final acceptance)

The effect of a series of electroconvulsive seizures on some measures of activity in the male albino rat 141
By John A. Stern

A functional approach to clinical psychology 153
By Abraham S. Luchins

Experimental inhibition and restoration of mating behavior in male rats . . 165
By Frank A. Beach, Myron W. Conovitz, Frederick Steinberg, and Allan C. Goldstein

The relationship of place and turn alternation to reactive inhibition . . . 183
By Betty J. House

Patterns of aggression in parents and their children 199
By Robert D. Hess and Gerald Handel

(OVER)

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Electroconvulsive shock and the learning of visual patterns 213
By W. Lynn Brown and A. D. Simpson, Jr.

The structural aspects of schizophrenic responses to auditory stimuli . . 221
By Howard Friedman

Age and suitability for nondirective play therapy 231
By Dell Lebo

An assessment of personal-social adjustments of a group of middle-class mothers 239
By Vaughn J. Crandell and Anne Preston

WISC scores and status in reading and arithmetic of delinquent children . 251
By Helen M. Richardson and Elise F. Surko

Trends in the "fears and worries" of school children as related to socio-economic status and age 263
By Henry Angelino, Joseph Dollins, and Edmund V. Mech

SHORT ARTICLES AND NOTES 277

Empathic and sociometric status among young teen-agers (Grace Rose, Norman Frankel, and Willard Kerr) 277

BOOKS 279

CRITICAL REVIEWS OF RECENT BOOKS 281

Werner, Heinz, Jr., *Ed.* *On Expressive Language.* (Reviewed by Michael Wertheimer) 281

BOOKS RECENTLY RECEIVED 283

The Journal of Genetic Psychology, 1956, **89**, 141-151.

THE EFFECT OF A SERIES OF ELECTROCONVULSIVE SEIZURES ON SOME MEASURES OF ACTIVITY IN THE MALE ALBINO RAT*

Department of Psychology, University of Illinois

JOHN A. STERN

A. PURPOSE

The purpose of this experiment was to determine the effect of a series of electroconvulsive seizures (*ECS*) on activity as measured in an activity wheel and in an open field.

This study was conceived to determine some of the behavioral changes associated with *ECS* which many authors have referred to in passing, but which have apparently not been studied in any systematic manner (1, 2, 3, 4, 5, 6, 8, 9).

Stone (11) and Winder and Stone (12) reported on the effect of a series of *ECS* on activity wheel running. Their results indicate a reduction in activity both while *ECS* was administered and for some time thereafter. It was, in part, because of their positive findings of a series of *ECS* affecting activity wheel running that this measure of activity was utilized in this study.

The open field situation was decided upon as another behavioral measure because of apparent behavioral changes noted by some of the above authors and by us. Some of the changes we had noted in the home cages of animals subjected to a series of *ECS* were: huddling together in rear of cage, not approaching cage door when door is opened, and resistance to being removed from the cage. In handling animals subjected to a series of *ECS* we found some of them to remain "tense" while being handled, as well as crouching in the weighing pan while they were being weighed.

B. METHOD

1. *Subjects*

Subjects in this experiment were a group of 24 male albino rats drawn from stock maintained by the Department of Psychology of the University of Illinois. The animals were divided into three experimental groups by random selection. There were 8 animals in each of the groups. During

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*Received in the Editorial Office on November 15, 1954, but delayed in publication because of the fire.

the experiment one animal in each group died, so that our results are based on 7 animals in each of the following groups:

Group 6 ECS. This group was subjected to six electroconvulsive seizures administered at the rate of one per day.

Group 16 ECS. This group was subjected to 16 electroconvulsive seizures administered at the rate of one per day.

Group C. These animals were handled in the same manner as the 16 *ECS* group except that they were not subjected to the electroconvulsive seizures.

2. *Apparatus*

a. Activity wheels. Activity wheels utilized were constructed to measure movement in both directions. Animals were introduced into the activity wheels through an opening in the side of the wheel. Wheels were mounted in banks of five, with a shield between each of the wheels.

b. Open field. The open field utilized in this study was a table top which measured approximately 3 x 5 feet. The field was divided into squares whose dimensions were approximately 12″ by 12″.

3. *Procedure*

The age at first measurement of activity wheel behavior was approximately 140 days and approximately 150 days for open field behavior. During the period of administration of *ECS* and for a period of 10 days prior to the first *ECS* all animals were on a 23-hour deprivation schedule for both food and water. This deprivation schedule was maintained for four days after the last *ECS* trial for the 16 *ECS* group and for 14 days after last *ECS* for the six *ECS* group. The deprivation schedule for the controls was the same as that for the two experimental groups. At the end of this time all animals were placed on *ad libitum* feeding and watering schedules for the remainder of the experiment. Thus all animals were maintained on the same feeding schedule throughout the period of the experiment. The results of *ECS* on weight were reported in a previous paper (10).

Before initiation of activity wheel measurements all animals had been returned to an *ad libitum* feeding schedule and had been on this schedule for a period of 10 days. Measurement of activity wheel running thus was initiated 24 days after last *ECS* for the 6 *ECS* group and 14 days after last *ECS* for the 16 *ECS* group. During activity wheel measurements each group of animals was brought into the room containing the activity wheels and animals were placed into the individual wheels in random order. Animals remained in the activity wheels for a period of 30 minutes daily for a total of 20 daily measurements. After the activity wheel period animals were returned to the room in which they were housed, were weighed, and then returned to their living cages. Each of the groups was in a separate cage. Activity wheel behavior for all groups was observed during the morning hours (7 A.M. to 9 A.M.).

After animals had completed 10 periods in the activity wheels they were introduced to the open field situation. Open field behavior was observed during the evening hours, approximately 12 hours after activity wheel behavior, and was observed for a total of 10 daily trials. Open field behavior was conducted in the same room in which the activity wheels were found. The procedure was as follows: Animals were brought into the experimental room and run individually on the table top. They were then returned to living cages. Animals were placed into the center of the open field and remained in the field for a period of three minutes. The following activities were observed and tabulated for each animal:

1. Traversals of 12″ squares—a square was counted as traversed after three-fourths of the animal's body had entered the square.

2. Face washing behavior—face washing behavior was counted when animal had both forelegs off table and was engaged in "scrubbing" his face.

3. Boluses defecated during trial—counting of boluses, regardless of size, as long as they could be distinguished as separate boluses.

4. Urinations in the open field—number of places in which animals had urinated.

5. Edge runnings—edge running was counted when animal extended at least its head over the edge of the table, only one extension per square was counted where the animal remained in the box for longer periods of time and projected its head over the edge of the box more than once. In the case of corner boxes two extensions were possible, one over each side.

4. *Results*

a. Analysis of activity wheel running. Figure 1 presents the median activity for each daily 30-minute period of activity wheel measurement. Median, rather than mean activity measures were used since our data, in general, did not appear to be normally distributed. For the same reason the data were subjected to non-parametric analyses, the Mann-Whitney "U" test being used throughout. Comparisons of activity were made for the odd days of the 20 trials as well as for total activity measured during the first 10 as well as second 10 days of activity measurement. Comparisons made were between the control and two experimental groups (C-6 *ECS*-16 *ECS*) as well as between the two experimental groups (6 *ECS*-16 *ECS*).

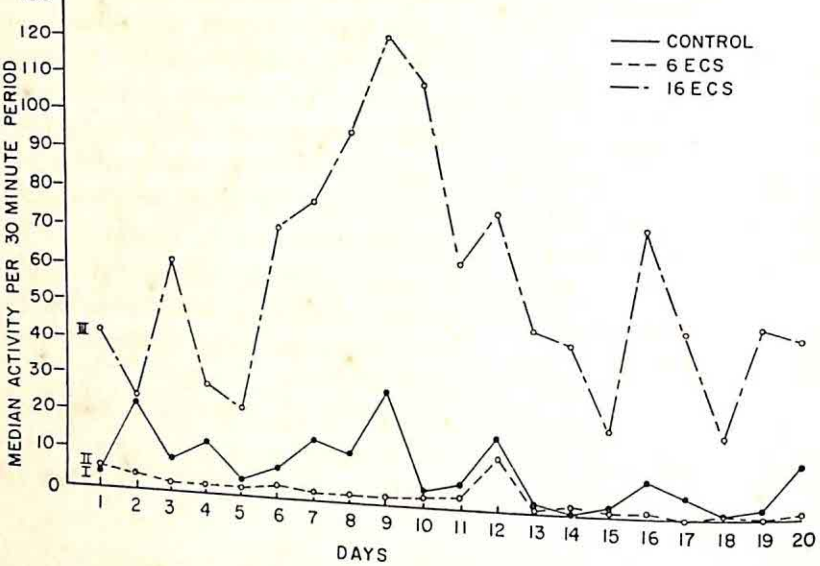

FIGURE 1
MEDIAN ACTIVITY FOR EACH DAILY 30-MINUTE PERIOD OF ACTIVITY-WHEEL MEASUREMENT

Table 1 indicates that for the 10 comparisons made between the control and 6 *ECS* group no significant differences were elaborated. The comparisons between the control and 16 *ECS* group show that for six of the 10 comparisons the differences between these two groups were significant be-

TABLE 1
ACTIVITY-WHEEL COMPARISONS BETWEEN EXPERIMENTAL GROUPS

Day	C-6 *ECS*	C-16 *ECS*	6 *ECS*-16 *ECS*
1	.191	.013*	.073
3	.267	.027*	.009*
5	.549	.027*	.104
7	.310	.042*	.010*
9	.451	.023*	.013*
11	.228	.056	.011*
13	.500	.056	.049*
15	.451	.104	.191
17	.130	.064	.003*
19	.355	.049*	.003*
Sum of 1-10	.451	.006*	.006*
Sum of 11-20	.355	.027*	.013*

*Significant at or beyond .05 level.

yond the .05 level of confidence. In all comparisons we find that the 16 *ECS* group consistently showed more activity than the control group. A similar comparison between the 6 and 16 *ECS* group produced like results; seven of our 10 comparisons were significant at the .05 level, the 16 *ECS* group consistently showing more activity than the 6 *ECS* groups. Using total activity for the first 10 and second 10 days we similarly find the 16 *ECS* group to be significantly different from both the control and 6 *ECS* group on both measures. Comparing activity for the first 10-day period to the second 10-day period for each group we find no significant differences in activity between the two sets of measures for any of our groups.

This analysis then indicates that under the above experimental conditions a series of 6 *ECS* have no effect on activity wheel running when compared to a control group while a series of 16 *ECS* increases activity wheel running significantly.

b. Analysis of table top behavior. Since a number of our table top measures seemed, for logical reasons, to be related to each other, rank order correlations between the various measures were computed. Table 2 lists these correlations. Analysis of table top movement, which was based on the number of 12″ squares traversed during the three-minute table top trial indicates a significant difference in such activity between the control and both experimental groups. Table 3 presents the results of significance tests between the various groups for trials run on odd days as well as for total activity for the

TABLE 2

RANK-ORDER CORRELATIONS BETWEEN TABLE TOP MEASURES

	Movement	Edge running	Defec.	Urin.
Edge running	.97			
Defec.	.28	.32		
Urin.	.39	.46	.79	
Face wash	.46	.48	.56	.45

TABLE 3

TABLE TOP MOVEMENT COMPARISONS BETWEEN EXPERIMENTAL GROUPS

Day	C-6 *ECS*	C-16 *ECS*	6 *ECS*-16 *ECS*
1	.0005*	.000*	.228
3	.073	.036*	.248
5	.027*	.019*	.500
7	.019*	.009*	.310
9	.228*	.073	.228
10	.01*	.002*	.217

*Significant at or beyond .05 level.

10-day period. The comparison between the control and 6 *ECS* group shows four of the six comparisons to be statistically significant; for the comparison between the control and 16 *ECS* group five of the six comparisons prove to be statistically significant; while none of the comparisons between the 6 and 16 *ECS* groups proved to differentiate between these groups. Figure 2 indicates that these differences arise because the control group is more active on the table top than either of the two *ECS* groups. Similar analyses

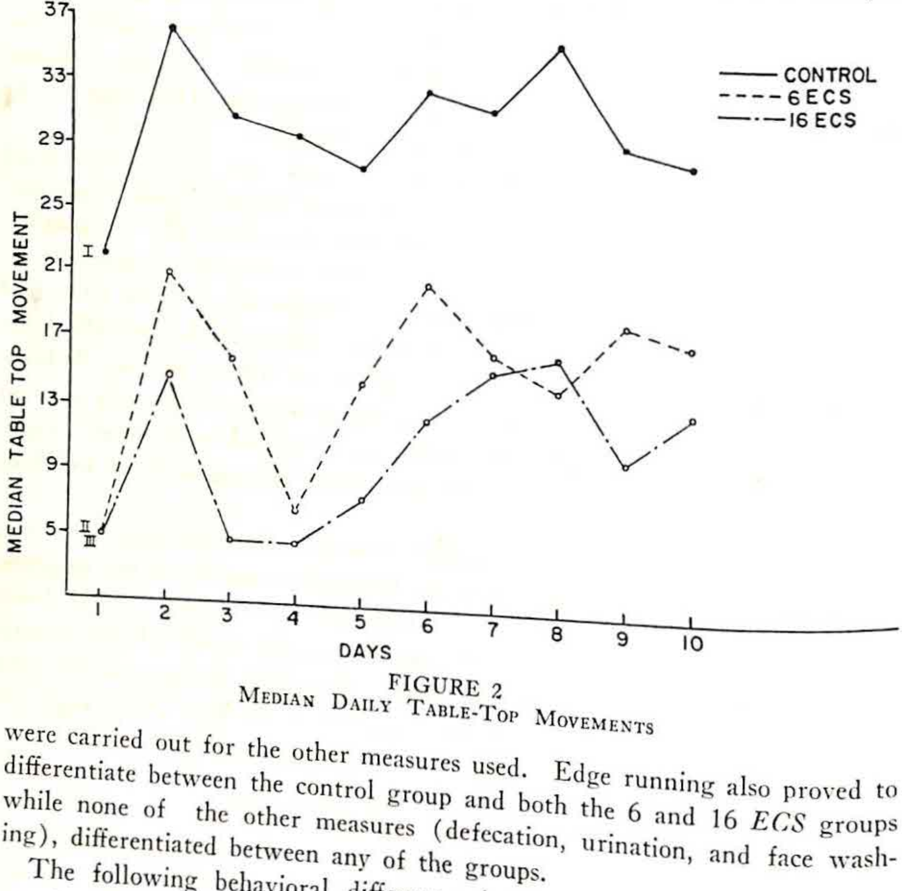

FIGURE 2
MEDIAN DAILY TABLE-TOP MOVEMENTS

were carried out for the other measures used. Edge running also proved to differentiate between the control group and both the 6 and 16 *ECS* groups while none of the other measures (defecation, urination, and face washing), differentiated between any of the groups.

The following behavioral differences between the various groups were noted. When the ratio between edge running and activity on the table top was computed for the first day of table top measurements it was found that all animals of Group *C* showed that between 40-95 per cent of their activity involved edge running (median of 48 per cent) while in both of the experimental groups we find only one animal each which exhibited any edge running behavior at all. Further comparison by use of this method was not utilized because of the large differences in amount of table top activity between the various groups and the relationship between these two measures. (Rank order correlation between amount of movement and edge running behavior produced a correlation of .97, indicating that with increased movement there is a concomitant increase in edge running behavior.)

Another difference noted, especially on the first day of table top activity, peculiar to all the animals of the 16 *ECS* group was that all these animals were active in a "nervous and jerky manner," they exhibited much turning and moving backwards behavior in the starting square. No such behavior was observed for any of the animals in the control group, while some of the animals in the 6 *ECS* group showed similar behavior.

Other differences between the two *ECS* groups and the control group noted were that the former groups showed much "hesitant" and "extensor" type of movement in which the animals kept their hind legs in position, utilized them as pivotal points and extended themselves in a number of directions. This behavior was especially noted when the animals were first placed into the starting position on the table. Most of the animals showing this type of behavior showed it throughout the 10-day period. Wheezing behavior was also more prevalent in the experimental animals than in the controls. The experimental animals also exhibited more "jerky movements" than the controls, jerky movements being defined as short and hesitant movements.

A difference in behavior while animals were being weighed was also noted, animals which had been subjected to *ECS* would lie quietly in the weighing pan, while control animals did considerable moving around. In the home cages control animals usually were more active and would cluster around cage door when experimenter came to cage. The *ECS* animals, on the other hand, would usually be found huddled together at the rear of the cage and would not come to the door when experimenter approached to open it.

C. Discussion and Conclusion

The results of this study indicate that activity, as measured by both activity wheel and open field behavior, is altered when animals have been subjected to a series of 16 electroconvulsive seizures under conditions of food and water deprivation. Both the statistical analysis and the graphs indicate that these two measuring instruments apparently measure somewhat different aspects of activity, i.e., in activity wheel behavior, as utilized in this study, we find that rats subjected to a series of 16 *ECS* show a definite increase in activity, whereas the table top measure of activity indicates that these same animals show a significant decrease in activity as measured by this method.

Before attempting to account for the differences in activity as measured by these two measuring instruments let us review the behavior of animals on the table top. We found that, in general, the animals which had been subjected to a series of *ECS* behaved in a more "emotional manner." Emotionality as used here being defined as an increase in, or appearance of such behaviors as hesitant and extensor type movements; quick, jerky movements; constriction of activity to center of field; boluses defecated being in general less viscous, more diarrhea-like; exhibition of facial "tics" and wheezing behavior. It seemed, in general, that these animals constricted their field of action. While normal animals explored the entire field, evidencing much activity and considerable edge running behavior, our experimental animals showed a high degree of constriction of behavior, sticking close to the center of the field, to the areas of the field into which they had been introduced by experimenter.

Comparing our findings for activity wheel behavior with those of Winder and Stone (12) we must first of all note that the two studies are not directly comparable since in the latter study animals were housed in cages permitting free access to wheels during periods of measurement of activity and that their measures were taken at different times and in a different manner. In their study animals were given a series of five daily *ECS*; five days without *ECS*; for three alternate periods of *ECS* and no *ECS*. They found that their procedure produced "significantly reduced concurrent activity as compared with (*a*) pre-shock activity, (*b*) 5-day periods of no-shock interposed between periods of shock, and (*c*) the post-shock period." They further concluded that the effect of successive periods of shock was cumulative since the mean level of activity reached during the 30-day post-shock period was significantly lower than that of the pre-shock period. This observation is tempered by the statement that due to the absence of a control group they were unable to state whether this effect was "due to natural decline in activity with age or to lingering effects of electroconvulsive shock." In an earlier study using female rats Stone (11) found that the above procedure produced a reduction in amount of voluntary activity for a short period of time, the major changes appearing within the first 24 hours after the last *ECS* was administered. With this group of animals he found that within two weeks after their last convulsion the majority of animals closely approximated their pre-shock levels of daily activity. Utilizing only our

6 *ECS* group for the moment, it would seem that our findings for this group are comparable to Stone's results with a group of female rats, i.e., activity wheel measures taken more than two weeks after last *ECS* do not discriminate between *ECS* and control animals, or in Stone's case between pre- and post-*ECS* measurements. When we look at the findings for our 16 *ECS* group we find a radical difference in results between our study and those of Stone (11) and Winder and Stone (12). It seems that a group of 15 *ECS*, when not given on successive days causes either a decrease in activity during administration of *ECS* with no long lasting change in activity (11), or causes a decrease in activity wheel running both during administration of *ECS* and for a period thereafter (12). The animals in our study subjected to 16 daily *ECS* showed a significant *increase* in activity wheel running as measured between 14 and 34 days after last *ECS*, those subjected to a series of 6 daily *ECS* showed no significant change in activity (as compared to a control group) as measured between 24 and 44 days after last *ECS*.

Another important difference between the above two studies (11, 12) and ours was that our animals had been maintained on a 23-hour deprivation schedule during the administration of daily *ECS*, while animals used by the above authors had free access to food and water at all times. (A study recently completed in which animals were kept on *ad lib* feeding schedules throughout the experiment suggests that this is an important variable since the *ECS* animals in this study could not be differentiated from controls on the basis of activity wheel running.) The period of feeding while on deprivation schedules coincided with the hours activity wheel measurements were taken. It is a possibility that the animals subjected to 16 daily *ECS* continued to feed at the same definite and restricted time upon being returned to *ad lib* feeding schedules. Since an increase in activity, as measured in activity wheels, is generally found for the periods preceding feeding (7), the increase in activity shown by the 16 *ECS* group could be accounted for.

Another possible explanation is that the series of *ECS* fixated the response in question (increase in the type of behavior reflected in increased activity wheel running). It might be argued that the animals had acquired an "expectation" of feeding, a consequence of this being the increased activity wheel running. We can consider this behavior (the behavior reflected in increased activity wheel running) as having been conditioned to the expectation of food. Gellhorn (2) reports a study concerning the effect of convulsive shocks on the recovery of inhibited conditioned responses. He found that, "the repeated application of conditioned stimuli over many days causes, in spite of complete absence of reenforcing unconditioned stimuli, no weakening in the conditioned response" (2, p. 308). A similar order of events may have operated to produce the increase in activity found in our study in which the animals were on a deprivation schedule before, during, and for a short time after administration of a series of *ECS*. Increase in activity may have become conditioned to time of presentation of food, the conditioned response becoming fixated as a function of administration of a series of 16 *ECS*, a series of 6 *ECS* not being able to fixate the response.

Why should there be such differences in activity as measured in the activity wheel and on the table top? Our hypothesis is that activity in an activity wheel is similar to activity in an enclosed cage, whereas activity in an open field is an entirely new experience, and that the two do not measure the same kind of "activity." It is in their reaction to the new experience (table top) that all our *ECS* animals differed from controls, the *ECS* animals constricting their field, i.e., confining their activity to the center of the table top where they had been placed by experimenter, while control animals actively explored the field. It further seemed that the experimental animals were more "emotional" and that this "emotionality" was diffusely expressed—as evidenced by the variety of indicators of "emotionality" found on the table top.

D. SUMMARY

Three groups of animals were utilized in this experiment; a control group, a group of animals subjected to daily *ECS* for six days, and a group subjected to daily *ECS* for 16 days. All animals had been maintained on a 23-hour food and water deprivation schedule for 10 days before first *ECS* until four days after the 16 *ECS* group had completed its series of *ECS*. These animals were then tested in activity wheels (measurements initiated 24 days after last *ECS* for the 6 *ECS* group, 14 days after last *ECS* for the 16 *ECS* group) and in an open field situation (measurements initiated 34 days after last *ECS* for the 6 *ECS* group, 24 days after last *ECS* for the 16 *ECS* group).

The findings are as follows:

1. A series of 6 *ECS* had no effect on activity wheel behavior.
2. A series of 16 *ECS* increased activity wheel running significantly.
3. A number of measures of table top behavior differentiated between animals subjected to no *ECS* and those subjected to either 6 or 16 *ECS*. They did not, however, differentiate between the 6 and 16 *ECS* groups.
4. A number of other behavioral changes attributable to *ECS* were found and discussed.

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A FUNCTIONAL APPROACH TO CLINICAL PSYCHOLOGY*

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The *raison d'être* of clinical psychology is contingent on its making a contribution different from that made by the psychiatric profession. The clinical psychologist's future does not lie in his being a "non-medical psychiatrist," but in the contribution he can make by being an expert in the behavioral sciences. He does not have to compete, uneasily, with medical therapists; he has a unique contribution to make as a social therapist. In order to do this he must understand the relationship between the individual and the social field, how social forces can contribute to clinical phenomena, and how these forces can be manipulated for therapeutic effects.

In line with this conception of the clinical psychologist, the training program to be proposed aims to turn out a graduate who is well versed in the behavioral sciences. This means that he will have to be acquainted with disciplines other than psychology that have accumulated information about the interaction between the individual and the social field. The proposed program will therefore attempt to be multidisciplinary in nature.[1] While doing so, the focus will be on clinical phenomena. It is a fundamental assumption of the program that the focus should always be on actual clinical phenomena, on the problems to which they give rise, and on the functions performed by the clinician in attempting to meet these problems.

To guide them in developing courses and practicum training, the planners of a functional program ought to know the functions performed by psycholo-

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*Received in the Editorial Office on March 10, 1955.

[1] It is important to note the sense in which the term multidisciplinary is used here. This term is employed since the program attempts to convey to the students some knowledge of several disciplines and some understanding of the relation each discipline has to clinical phenomena. The term is not to be interpreted to mean that the program plans to turn out experts in all of these disciplines. Nor is it to be interpreted to mean that the program aims at integrating, synthesizing, or in any way fusing the various disciplines. In this respect, the program differs from some courses, described as multidisciplinary, that consider the integration of various disciplines to be a principal objective (an objective that is rarely achieved).

It seems to the writer that it is neither necessary nor desirable that the clinical psychology program strive to synthesize the behavioral sciences. What is desired is that the student become acquainted with various disciplines to the extent that he can draw upon them when confronted with clinical phenomena. In other words, the aim is to give him a multitude of resources from which to draw concepts, tools, and approaches with which to deal with clinical phenomena.

gists. To discover these functions, it may be advantageous to make continuous surveys that aim at finding out what functions are at present performed, as well as what functions ought to be performed by psychologists in order to meet the needs of certain institutions in the community. A myoptic view will be avoided if the results of the surveys conducted in different communities are coördinated by the *APA* or by some other national group, and the coördinated information made available to universities. Such information can serve as a foundation on which to build training programs sensitive to the present and future needs of institutions requiring the services of clinical psychologists.

The students themselves can help to make the surveys and can do so throughout their years of training. They will, thereby, not only help to execute the surveys but will also gain first-hand information about the functions of clinical psychologists. Each student will be sent to observe institutions in the university; for example, the counseling service, educational and vocational services, speech and hearing clinics, special education classes, etc. Outside the university they may visit, for example, hospitals and clinics; institutions for the feeble-minded; homes for the aged; orphanages; welfare agencies; family counseling services; rehabilitation or training centers for the mentally, emotionally, or physically handicapped; courts; jails; reformatories or other correctional institutions; community planning agencies; advertising agencies and industrial plants. This means that the university will have to gain the coöperation of as many installations as possible that can serve to enrich the student's observational experiences. In his visits to each installation, the student will be asked to keep in mind such questions as these: "What kinds of clinical phenomena occur here? What problems do they give rise to? How does the psychologist here cope with these problems or how might a psychologist cope with them?" Moreover, since he is being trained as a behavioral scientist, he will also be interested in observing the social structure of, and social processes in, the installations. These visits will, incidentally, serve to give the student a bird's-eye-view of the various fields of specialization.

Depending on the student's interests and plans for specialization, some of the visits will be more intensive and extensive than others. For example, a student interested in working in psychiatric installations will spend more time visiting and observing a neuropsychiatric hospital. His visits may be organized along the following lines. He will spend a few days in a ward, observing the activities therein and finding out the various problems confronting the patients, ward attendants, nurses, physicians, and administrators. He will rotate among the wards, living first perhaps in the admissions' ward, then in the active-treatment ward, then in the chronic ward, and so on. He will compare his observations of the various wards, noting in what respects they differ and in what respects they are similar with reference to social structure, social processes, and problems. The student will also try to learn something about the relationship of the wards to each other and to the hospital as a whole. To this end, he will have discussions with the chiefs of services, with doctors, residents, nurses, psychologists, social workers, occupational therapists, and even the dieticians, cooks, and janitors. He will also attempt to learn something about the relation of the hospital to the community. He will therefore interview relatives and friends of patients who visit the hospital in an attempt to discover how they see the hospital and what problems they have in relation to it. He will also spend time with the public relations men of the hospital to learn about the kinds of problems they face. In short, he will attempt to make a survey of the hospital as a social institution and to grasp its problems, its social structure, and social processes, as well as its rôle and function in the community.

Coördinating the visits to the various institutions will be a professional colloquium that the student takes throughout his years of graduate training. During the meetings of the colloquium, students will report their observations, both those made during brief visits as well as those made during more extended visits. In this manner, students working in different installations can share experiences, can get a picture of what is happening in various other institutions, and can help one another in proposing solutions to the problems which they meet. It will be of value if some of the sessions are attended by psychologists and other individuals working in the visited institutions. This will help to keep the observations and the proposals for solutions rooted in concrete reality. It will also enhance the value of the colloquium if it is attended by all members of the psychology department(including those whose primary interest is not clinical psychology), by faculty members of the other behavioral sciences, as well as by members of those departments that have a special interest in the particular institution that is being discussed. For example, some of the sessions might be attended by members of the departments of sociology, anthropology, political science and economics; by members of the law school to comment on legal aspects; by members of the education department to comment on aspects of general and special education; by members of the art, music, literature, and dramatics department to comment on use of these arts for therapy; by members of the business administration school to comment on administrative problems. It is not even farfetched to bring in members of the school of architecture to deal with the physical aspects of a ward, hospital, or clinic. Although the emphasis will be on understanding the particular institution and clinical phenomena under discussion, all faculty members will take it upon themselves to point out the theoretical issues and the theoretical problems involved in the discussions and to highlight the theoretical implications of the observational material as well as of the proposed solutions to problems. This may help to sensitize the student to, and interest him in, the theoretical issues that exist in the practice of clinical psychology.

It is conceivable that the student's doctoral research will develop from discussions held during the professional colloquium or from his visits to various installations. It may not be out of place, therefore, to mention here that certain changes may have to be made in the requirements of doctoral research. It is customary to demand of such research that it be tied to theoretical issues or that it make an original or basic contribution to psychology as a science. But if the student is dealing with actual problems involved in clinical phenomena, it should not be necessary to demand of him that he link the problems to theoretical issues or that he contribute to basic science research. Nor should it be required of the student that he solve the problem. One's work should be considered acceptable if one conducts careful empirical research, shows understanding of the problem and some progress toward a solution (for example, by pointing to variables involved or by helping to reformulate the problem so that it is more amenable to research and to possible solution), or shows why it is an unsolvable problem. In short, the training program does not have to be primarily concerned with turning out a theoretician. Those students who are interested in theoretical foundations or basic science aspects underlying clinical phenomena should be allowed to work along these lines, but it is not necessary to force every student to do so as long as there are practical problems that are in urgent need of investigation. Such a proposal is not unique. For example, a doctoral dissertation in chemistry may deal with a practical problem which does not contribute to a general theory in chemistry; every graduate student in chemistry does not have to be a Mendeléeff.

Moreover, if the central interest is the problem at hand, it may be necessary that the student go outside the domain of psychology in his search for a solution. He may have to work closely with faculty members of other departments, perhaps with some of those attending the professional colloquium.

Visits to other installations and participation in the professional colloquium certainly do not suffice to make a clinician out of the student. The visits cannot serve as substitutes for practicum experience; rather, they may be regarded as observational orientation to installations in which the student will later get practicum experience. Each student's practicum experience should cover as many different kinds of functions, in as many different kinds of installations, as is feasible. This will help to turn out a graduate who is so flexibly trained that he can undertake many of the functions performed by clinical psychologists. At the same time, it will help to enlarge the student's employment prospects.

As far as the formal courses are concerned, they will include both those that are primarily concerned with testing, diagnosis, and therapy, as well as those that are primarily concerned with theoretical foundations. Here again it is important to emphasize that these will be interrelated, since running through all the courses will be the unifying thread of the actual clinical phenomena that the students encounter.

Attempts will not be made to teach the students all clinical tests and techniques in formal courses. Many can be learned, with economy of time and effort, in the practicum training and in the visits to various installations. The aim will be to teach the student the regions of applicability and the limitations of leading tests and techniques. The clinical instructor will also point to theoretical implication which the test may have with reference to learning, thinking, perceptions, motivation, etc., thereby helping to link the clinical practical courses with the theoretical-foundation courses. The student will be encouraged not to become test-centered or tool-centered. He will be encouraged to keep in mind that of prime importance is the clinical phenomenon facing him and not his little bag of test tools. The student will learn to observe the clinical phenomenon before he decides what techniques he should use for testing, rather than to decide on his tools beforehand when he does not yet know what it is he is testing or measuring. In other words, the program will not foster the viewpoint that there is a certain test or battery of tests which should be applied in all clinical situations. Moreover, the student should realize, as does the physicist, that the instrument or method of measurement may itself influence the object of measurement. Naturalistic observation should, therefore, be used before, during, and after each test and the student should try to understand how the patient reacted to the test and what effect it had on him. [See (1) for elaboration of these ideas and for a description of an in-service training program incorporating these ideas.]

The teaching of clinical practices will attempt to make the student realize that a diagnosis, considered as a category in which to pigeon-hole the patient, should not be the main objective of testing. The emphasis will be placed less on a diagnosis considered as an outcome of testing, and more on the *diagnostic process* considered as a rather continuous process of evaluation of the therapeutic process during treatment and even after [cf. (4) for the principles underlying this approach to diagnosis].

It is important to note that the student will be taught something about diagnostic processes used in physical anthropology, neurology, optometry, audiometry, speech pathology, etc. This is to help avoid errors in the interpretation of intellectual or personality functioning that may occur if the examiner does not take into account the possibility that responses to the tests were influenced by neurological, visual, auditory, or speech defects. The students should receive sufficient training so that they can make a preliminary assessment of the possible operation of such factors. They should also know to whom to turn for consultation on these matters and they should be able to understand reports of the results of neurological, audiometric, optometric, or other physical examinations.

In the teaching of therapy, the aim will be to give the student the opportunity to observe and to practice, under supervision, leading approaches to both individual and group therapy. In other words, rather than being taught that one approach is *the* respectable or the most effective form of psychotherapy, the teaching will offer varied approaches (3). Fundamental assumptions and implications of the theory underlying the therapeutic techniques will be discussed. Here, as in the teaching of tests, we will try to turn out a student who does not center on the therapeutic procedure *per se*, but who centers on the clinical situation. He will be encouraged to adopt an experimental approach to each clinical situation and to use the therapeutic techniques that seem best to fit the particular problems of the specific patient, or group, rather than to assume at the outset that one therapeutic technique is necessarily best in all situations.

The student's intellectual horizon should extend beyond conventional psychotherapeutic techniques. He will therefore be acquainted with group dynamics and action research. He will learn something about how to manipulate and control group behavior to bring about certain desired ends. He will be briefly acquainted with educational and remedial teaching techniques used in teaching normals as well as in teaching the physically, mentally, or emotionally handicapped; with occupational therapy, recreational therapy, rehabilitation therapies of various sorts, speech therapy, and other special kinds of therapy. He will be acquainted with the various special services that have been included in hospitals to create a therapeutic climate for the patients; for example, library activities, dramatic groups, current event groups, music or art appreciation sessions, patient government, and so on. It is not necessary that he be expert in any of these special therapies or special services. But he should have sufficient knowledge of what is involved in them so that (*a*) he has some ideas about the experiences encountered by a patient who engages in one or another kind of special therapy or special service, (*b*) he knows when to recommend a patient for some special therapy or service and how each can contribute to the solution of the clinical problem at hand, and (*c*) he can be of assistance when his psychological services are required by those who administer the special therapies or special services. [See (3) for further details concerning the teaching of therapy.]

Finally, let us consider the theoretical foundation courses. While we want the student to learn about other behavioral sciences, it may not be advisable to make him take any large number of courses in other departments. For one thing, the planned program does not allow him much time for this. Moreover, we cannot expect that all of what is taught in another department's course will be needed by the clinical student. Nor can we expect such a course to be oriented toward clinical phenomena. The more advisable procedure will therefore be to arrange some joint seminars or classes coördinated by the psychology department, in which members of other fields are invited to deliver a series of lectures. A few well-chosen lectures on, say, sociology, anthropology, or political science, can serve to initiate the student into these disciplines and to show him their relationship to clinical psychology.

It is contemplated that the theoretical foundation courses cover the following areas:

1. A survey of the fundamental problems and concepts of various behavioral sciences. Also, a survey of the contribution each can make to clinical psychology through its orientation, concepts, and techniques.

2. A survey of concepts and problems related to individual behavior, dealing with such topics as learning, thinking, problem solving, motivation, sensory and neural processes, work and fatigue, the physiological basis of behavior, psychopathology, psychoanalysis, etc. Attempts will be made, both by the instructors and the students, to relate these topics to concrete clinical phenomena which they have encountered.

3. A survey of institutional behavior dealing with such institutions as the family, the school, the church, courts, jails, industry, and others. The

aim will be to give the student an understanding of institutions in our society, their structure, and their interrelationship.

4. Dynamics of group behavior both for large and small groups.

5. A survey of the various kinds of mathematical tools which can be of assistance in dealing with psychological problems so that the student may learn where to go in the field of applied mathematics to get the tools he needs.

Some remarks are in order concerning the feasibility of this program. Can it be accomplished in the four or five years currently allowed for clinical training? Based on his experiences in training clinicians, the writer believes that the proposed program can be achieved during a four-year period and that it is not overambitious. Certainly it would be overambitious if one hoped to attain all the objectives of the proposed program while also including all the courses and training of some other clinical program. Finding time for the observational experiences, practicum experiences, the professional colloquium, and other courses delineated in this report, will probably require devoting less time to certain aspects now stressed by other clinical programs.

Many clinical programs devote considerable time to training in certain tests. They may require each student to take some courses on the Rorschach test and to complete the administration and scoring of a stipulated (large) number of Rorschach tests; similar requirements may hold for the Binet, the Wechsler-Bellevue, and other tests.

The writer wonders whether such intensive training in specific tests should be a prerequisite for the doctoral degree in clinical psychology. To begin with, there is a possibility that the student is "overlearning" or is being "overtrained" in certain tests. Research is needed to discover the degree of training that is needed for learning to administer, score, and interpret a given test and whether, after a while, one tends to reach a point of diminishing returns as far as further training is concerned. Moreover, the details of analysis and the intricacies of interpretation that are taught to the student (for example, with reference to the Rorschach test), may not be commensurate with the simpler level of analysis and interpretation which is all that may be required in his professional functions. Here again, research is needed to discover the actual level of analysis and interpretation that tends to be used by clinical psychologists in various installations.

The proposed program holds that the student should receive sufficient training in the tests so that he is equipped adequately to administer, score, and interpret the tests, but that he does not have to be a specialist in any test before he gains the doctorate. The dangers involved in aiming at a specialist in certain tests is that one may neglect other functions of clinical psychologists and that one may foster a test-centered approach toward clinical phenomena (2). The proposed program will, therefore, not include as many courses devoted to specific tests as is the case in some other programs. Nor will it require of the student that he administer a large number of any given test prior to graduation. The stipulation that the student complete, for example, 50 or 60 Binet tests, may be a carryover from the days when the clinical psychologist's main task was to administer Binet tests, but today the clinical psychologist is more than a psychometrician and his functions go beyond administering, scoring, and interpreting the Binet, the Wechsler-Bellevue, the Rorschach, or any other test.

What the proposed program will attempt is to foster the development of a learning set, "learning to learn," in the sense in which Harlow (1) uses such phrases. It will, therefore, be expected that the student be amenable to further development in knowledge about and the skill in the tests during his internship period and thereafter. During his internship he can gain further experience with the tests (perhaps completing a stipulated number of each) and can consult with others, if necessary, for test reports that seem to require more experience than he possesses. Moreover, the student who is interested in specializing in any test can do so during post-graduate training and in post-graduate courses. This is analogous to what happens in medical school where the granting of the M.D. degree is not made contingent on the student becoming a specialist or completing a large number of any given medical practice. Thus the student does not have to deliver one hundred babies before he gains the M.D. degree, but during his internship he does have experience in delivering babies that counts toward the certificate in midwifery; and the student who is interested in specializing in some aspect of medicine is expected to do so after graduation and not prior to receiving the doctorate in medicine.

While the program sketched in this paper is considered by the writer as being feasible, he is aware that there are formidable problems involved in bringing the program into realization. Planners and administrators of the program will have the task of gaining the coöperation of faculty members in the psychology department and in other departments, and of coördinating their efforts. They will be faced with the complex problems involved in gaining the coöperation of institutions in the community and in planning the visits and practicum training so that interference with the needs of the institution is minimized while the benefits to the student are maximized.

There is the very practical problem of what aspects of the installation's function and structure should be demonstrated to the student and in what order they should be demonstrated. There is the further important problem of the order in which to arrange visits and training in the various installations so that they constitute a rather graduated and integrated series of clinical experiences. There is, also, the problem of who should supervise the visits and training in the various installations. It may be necessary to have demonstrators or clinical teachers in some of the installations. A training program—at least a workshop—for such demonstrators may have to be initiated. All this calls for close coöperation and for frequent interchange of ideas between the university and the coöperating installations.

The proposed program requires teachers who are capable of, and not adverse to, working closely with members of other faculties; who are able, when teaching theoretical foundation courses, to link what they say to clinical phenomena; and who are sensitive to theoretical assumptions and implications in teaching clinical practices.

The program calls for students whose mental endowment and whose capacity for work are not less than those of the successful medical student. Students should be prepared to carry a heavy load during their years of graduate work.

Above all, there is a need for an experimental approach on the part of all who are concerned with the program. They must be ready to stand back and to try to ascertain the efficacy of their efforts and to modify or change when this seems necessary. The administrators of the program—working closely with, and consulting with, the teachers, students, and coöperating installations—should be willing to change methods and even certain objectives. That same experimental attitude which the program hopes to instill in the students, with reference to clinical phenomena, should be applied to the planning and execution of the program.

There is an adage which states that a snake must shed its skin or perish. Contemporary clinical psychology programs may be likened to the skin in which the body of clinical psychology is now confined. If this body is to flourish, it may be necessary that the present skin be shed. The present report attempted to delineate another possible "skin." It is hoped that it will be sufficiently flexible not to thwart the development of the body of clinical psychology and, that it will be put on with a workable zipper so that it can readily come off in order to be changed or even discarded whenever modification or shedding seem essential for the healthy growth of clinical psychology.

SUMMARY

The clinical psychology training program proposed in this paper is based on a number of premises and definitions, including the following:

1. A clinical psychologist may be defined as an individual, well versed in the behavioral sciences, who brings his knowledge to the clinical situation in order to utilize his senses more effectively.
2. A clinical psychology training program—at least one that calls itself functional—should be founded on the professional functions of clinical psychologists. This calls for surveys to discover just what these functions are.
3. The most effective training program is a multidisciplinary program which transcends narrow departmental lines.
4. The training program should aim to produce a graduate who is so flexibly trained that he is capable of effectively performing many or all of the professional functions which may be required of a clinical psychologist, in many or all of the institutions in which clinical psychologists may be employed.
5. The students should be acquainted with a variety of diagnostic and therapeutic procedures, not restricted to those conventionally used in psychology. But it is not necessary to aim at producing a specialist in any specific test or technique.
6. The focus of the training program should be clinical phenomena and the problems to which they give rise; the approach should be phenomenon-centered and problem-centered.
7. An experimental approach should be used in formulating the program and in executing it. An experimental attitude toward clinical phenomena should be developed in the students.

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The Journal of Genetic Psychology, 1956, **89**, 165-181.

EXPERIMENTAL INHIBITION AND RESTORATION OF MATING BEHAVIOR IN MALE RATS*

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A. INTRODUCTION

A number of unsystematic observations indicate that the sexual responses of male animals may be inhibited if coital attempts are associated with pain or fear (1, 2). An unpublished study by Wheeler (7) revealed that the mating reactions of male rats may be modified if the animals receive punishing shocks just before or during the act of copulation.

The aims of the present experiment were (*a*) to produce inhibition of mating tendencies in male rats, (*b*) to compare the effects of two different levels of shock upon sexual performance, and (*c*) to investigate the effects of electroconvulsive shock on any males that did not spontaneously recover from the experimentally created inhibition. The feasibility of the third objective was suggested by earlier findings that *ECS* produces an increase in the sexual performance of some male rats (3).

B. SUBJECTS, APPARATUS, AND METHODS

1. *Subjects*

Nineteen mixed albino and hooded male rats, ranging from 85 to 120 days old at the start of the experiment, were subjects. These animals were chosen after preliminary tests with receptive females in which they demonstrated sexual vigor by ejaculating in at least two of four tests. They lived two to a cage in a room in which the light-dark cycle was artificially reversed so that mating tests could be made during the solar day.

2. *Apparatus*

The animals were tested in a cylindrical, sheet-metal arena, 30″ in diameter and 36″ high. The males were gradually adapted to wearing a rubber-

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*Received in the Editorial Office on March 12, 1955.

[1] This investigation was supported in part by a research grant (M-783) from the National Institute of Mental Health of the National Institutes of Health, Public Health Service. The study was designed and supervised by the senior author. Conovitz and Steinberg conducted most of the mating tests. Goldstein conducted some of the tests for spontaneous recovery and all tests before, during, and after *ECS*. Beach and Goldstein analyzed the results.

band harness which encircled the body directly behind the forelegs and held a metal electrode snugly against the skin just between the shoulder blades. The hair beneath the electrode was clipped short and soaked with electrode jelly. The electrode was fastened to an *RCA* female phonograph jack into which could be plugged a male jack wired to one side of the shocking circuit. A light flexible wire passed through an overhead pulley so that the male could move freely about the observation cage. The circuit was completed by contact of the male's feet against the metal screen floor of the observation cage.

The shock was produced by a 600-volt *AC* variable-output transformer supplied with a 110-volt *AC* current. The transformer was in series with a 250,000-ohm resistor and a timer. The timing device consisted of a condensor, relay, and telegraph key. When the key was depressed a shock of constant duration (approximately .75 sec.) was delivered to the animal.

The apparatus used to induce electroshock convulsions was of a standard design (3). The current of 50 ± 2 milliamps was applied for approximately .1 sec. through alligator clips attached to the rat's ears.

3. *Selection of Experimental Groups and Testing Schedule*

The subjects were divided into two groups which were equated in terms of the number of intromissions necessary to produce ejaculation during the selection tests. All males were then observed in a series of prepunishment tests with receptive females. Tests occurred at 4-day intervals with a few exceptions when five or six days elapsed between tests. The purpose of the prepunishment series was twofold: to accustom the males to mating while wearing the harness, and to obtain a baseline of sexual performance against which the effects of punishment could be evaluated.

Adaptation to the harness and lead wire was achieved in several stages, first allowing the males to mate wearing the disconnected harness, and in later tests plugging in the wire lead. In the beginning all males scratched at the harness and tried to shake the wire loose, but this behavior disappeared and adaptation was judged complete after an animal had ejaculated in two successive tests while wearing the harness connected to the wire and with electrode jelly under the electrode. These final two adaptation trials were followed by four more prepunishment tests. During these six tests behavior stabilized and results obtained in the last test have been used as a measure of normal performance.

Following the prepunishment series all males were observed in a series of punishment tests. Details of the testing technique are presented below, but during the punishment tests the 10 males in Group *HS* (high shock) were given a shock of 380 volts when they attempted to copulate with the receptive female. Eventually all of these rats reached the criterion of "sexual inhibition," i.e., two successive tests in which no attempt was made to mount the female. After inhibition had been demonstrated, postpunishment tests continued (with the harness and lead wire, but without shock) until a male had copulated and ejaculated in three successive tests, or until the subject had been tested eight times without showing any mating reactions.

The nine males in Group *LS* (low shock) received two series of punishment tests. In the first series, a shock of 100 volts was delivered when a male attempted to copulate. The current was sufficient to evoke flinching or jumping when the male was alone, but in no instance did this degree of punishment eliminate copulatory reactions. The first series of punishment tests was continued until the average number of tests received by Group *LS* males was comparable to the mean number necessary to produce sexual inhibition in members of Group *HS*. This average for Group *HS* was 6.4 tests, and the mean number of tests for *LS* rats was 7.8, the range for different individuals being 6 to 11.

On the fourth day after the final punishment test in the first series, *LS* males were shifted to high shock. They now received a 380-volt shock as punishment for attempting to mate with the receptive female. The high shock tests were continued for each animal until the criterion of sexual inhibition was met.

Approximately two weeks after the final test of *LS* animals, 16 rats from Groups *HS* and *LS* were given a final recovery test. This and all subsequent tests were conducted in a different room, a previously unused observation cage and without the harness or electrode jelly. At this time some males in Group *HS* had not been tested for nearly two months. This final recovery test provided a measure of sexual behavior for all animals at a comparable stage. A few previously inhibited individuals exhibited copulatory reactions in this test. Those males that did not mate in the retention test and had not copulated since inhibition had been produced by the high shock were used for further experimentation to determine the effect of electroconvulsive shock.

A total of six inhibited males survived the convulsive treatment in good condition. Of these, three received 12 daily shocks, with *grand mal* seizures, and were tested for sexual behavior 20 hours after the 4th, 8th and 12th shock treatments. Following the conclusion of shock treatment three "recovery tests" were given at the usual intervals.

The other three males served as controls. They received three mating tests during the time that the first three were given shock therapy. During this period the control rats were removed from their cages each day and handled in the same manner as those that were being shocked. Alligator clips were attached to the ears but no shock was given. On the next 12 days the controls were subjected to convulsive shocks, being tested with receptive females 20 hours after the 4th, 8th, and 12th treatments. These males were given three recovery tests after discontinuation of shock treatment.

4. *Technique of Testing for Sexual Activity*

Stimulus females were animals that had been brought into heat by the injection of hormone.[2] They were used with experimental males only if they had exhibited full receptivity in an immediately preceding test with an "indicator male."

The harness was put on the male just before testing. The wire was attached and the male was left in the observation cage for five minutes before each test to allow for exploration and adaptation. The receptive female was introduced, a timer was started and a record was kept of the frequency of incomplete copulations (mounts without intromission), copulations (mounts with intromission), and ejaculations. Other scores included the time from introduction of the female to the first complete or incomplete copulation (mount latency) and the time of ejaculation. Prepunishment, punishment, and postpunishment tests lasted 10 minutes from the first mount, or from the introduction of the female if no mounting occurred. Tests run in connection with the electroconvulsive shock treatment lasted 15 minutes.

At the start of each punishment test males were allowed to copulate once without being shocked. Any mounts without intromission which preceded the first copulation were also unpunished. All subsequent attempts to mount were punished. The shock was delivered at the moment the male clasped the female with his forelimbs.

C. Results

1. *Per Cent of Group Attempting to Mate*

All 10 males in Group *HS* eventually reacted to high shock by failing to mount the female in two successive tests. Figure 1 summarizes the results.[3]

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[2] The estradiol benzoate (Progynon-*B*) and progesterone (Proluton) used in this study were generously supplied by Dr. Edward Henderson of Schering Corporation, Bloomfield, N. J. The dosage and timing of injections were those used in earlier studies (4).

[3] Successive points in the middle section of Figure 1 are based upon a decreasing

The first animal to become inhibited did so after two high shock tests, and the last male became sexually inactive after 13 tests. This final individual's record is included in the analysis of results but is not represented in Figure 1 because he was not tested for spontaneous recovery as were the other nine members of Group *HS*.

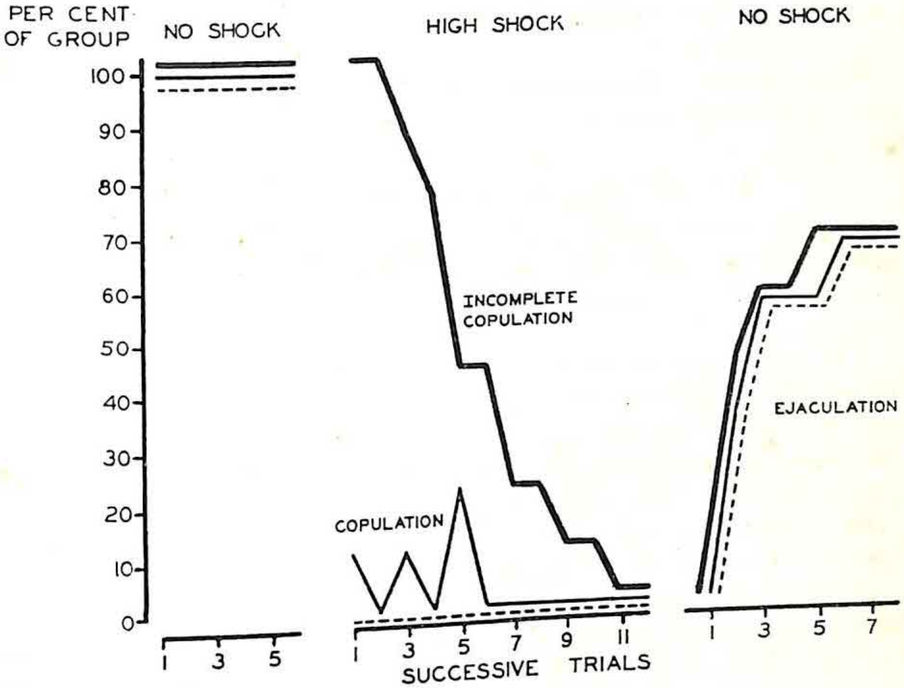

FIGURE 1
PER CENT OF GROUP SHOWING EJACULATION, COPULATION, AND INCOMPLETE COPULATION IN SUCCESSIVE TESTS BEFORE, DURING, AND AFTER THE PERIOD OF HIGH SHOCK

It had been anticipated that susceptibility to inhibition might bear some relation to the level of sexual performance in prepunishment tests. No such relationship was found, perhaps because the rigid selection of subjects had produced too homogeneous a group of high-potency males.

In meeting the criterion of inhibition, all rats in Group *HS* had spent the last two tests without mounting the female and therefore without re-

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number of cases. The number of high shock tests varied because some males were inhibited before others. However, in the figure the percentage of negative cases is cumulated up to the test on which the last male ceased responding sexually. The same procedure was followed in preparing Figure 2.

ceiving the punishing shock. Testing without punishment was continued for nine animals, and as shown in Figure 1, six displayed recovery of mating behavior. The six subjects began to copulate again on the third to the sixth nonshock test. This involved an interval of two to four weeks after the discontinuation of high shock. The remaining three males gave no sign of recovering from the experimentally-induced state of inhibition during the course of 8 to 10 nonshock tests.

Low shock did not eliminate mating behavior. All males in the *LS* group continued to mount the female repeatedly despite the 100-volt shock administered during all mounts following the first copulation. Seven of the nine males ejaculated in every low shock test. One ejaculated in four tests but copulated without ejaculating in two others. This same male behaved similarly in one prepunishment test. A second animal failed to ejaculate in one of nine low shock tests although he had never done so before punishment. The persistence of mounting behavior in Group *LS* is illustrated in Figure 2. The shift from low to high shock did not eliminate mounting behavior immediately, but as testing continued, more and more males ceased copulating,

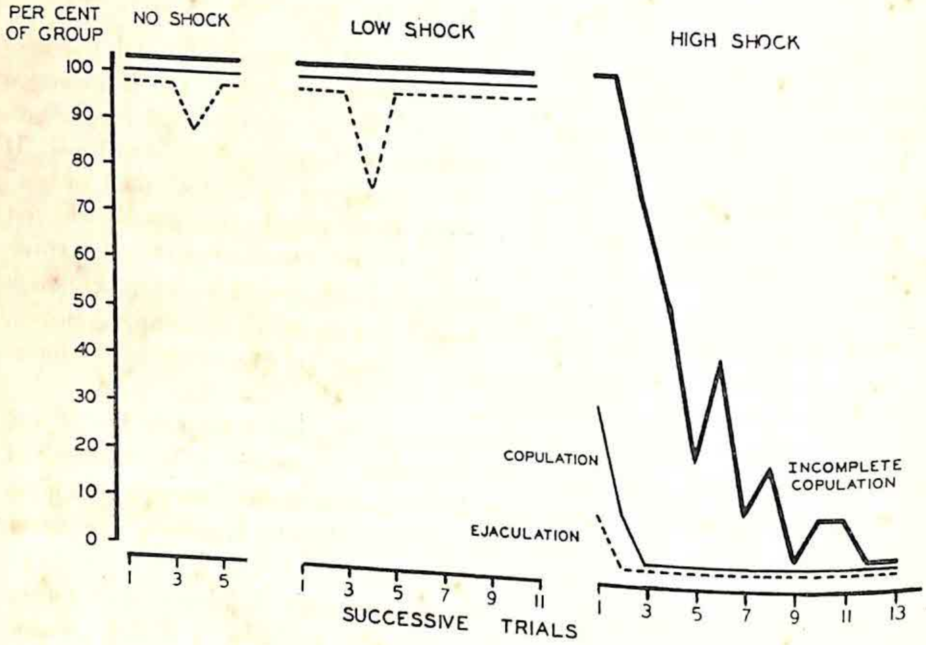

FIGURE 2
PER CENT OF GROUP SHOWING EJACULATION, COPULATION, AND INCOMPLETE COPULATION IN SUCCESSIVE TESTS WHEN DIFFERENT DEGREES OF PUNISHMENT WERE USED

and the individual most resistant to inhibition became sexually inactive after the eleventh test.

Comparisons of Groups *HS* and *LS* suggest that animals in the latter group were slightly more sensitive to high shock. *LS* males reached inhibition after an average of 4.9 high shock tests in the course of which an average of 52.2 shocks were received. Comparable figures for Group *HS* were 6.3 tests with 56.3 shocks. The differences are not statistically significant.

In the *HS* and *LS* groups there were 13 rats that spontaneously recovered from the inhibiting effects of high shock, and six that failed to do so. The 13 rats which showed spontaneous recovery were inhibited in an average of 4.7 tests and the six non-recovery animals in 7.7 tests. This difference is not significant. The average number of shocks administered to these groups during high shock were 46.1 and 72.3 respectively. This difference also is not significant.

For the above comparisons the absence of significance is clearly due to large within-group variability. All p values in this paper are based on two-tail mean difference tests except where noted.

2. *Frequency of Mating Responses*

Figure 3 shows that high shock altered the frequency of coital responses in tests where mounting occurred. *HS* males reacted to the introduction of shock with an immediate drop in the number of completed copulations, but in the first high shock test incomplete copulations were numerous. If complete and incomplete copulations are combined to give a "total mount" score, it is found that the frequency of mounting in the first punishment test did not differ significantly from that in the final prepunishment test. However, the total mount frequency decreased progressively in subsequent high shock tests. During the last punishment test in which mounting occurred, mount frequency was significantly lower than it had been prior to the introduction of shock ($p < .001$).

The effects of the 380-volt shock were severe, but they were not in and of themselves sufficient to prevent successful copulation. One member of Group *HS* and one of *LS* managed to copulate frequently enough to achieve ejaculation during the first test under high shock. However, this never occurred again in any of the high shock tests.

The central portion of Figure 3 illustrates changes in mounting frequency for the six *HS* males that showed spontaneous recovery of sexual activity. During high shock the frequency of copulation was very low and the total mount score declined progressively. The mean mount frequency in the last mount-positive high shock test was significantly below the preshock average ($p < .01$). When mounting behavior returned, its frequency was greater than it had been in the last mount-positive punishment test ($p < .01$), but less than the preshock average ($p < .05$). The frequency of complete copulations was very low during high shock tests and returned to normal in the recovery tests.

Low shock produced a progressive rise in the total number of mounting responses, as can be seen in Figure 3. The average for the first low shock test did not differ significantly from prepunishment performance, but in the last test under low shock the mean number of complete plus incomplete copulations was significantly greater than it had been before shock was introduced ($p < .01$). This change in mount frequency reflected a steady rise in incomplete responses. The number of copulations did not change significantly, but the number of incomplete copulations increased during low

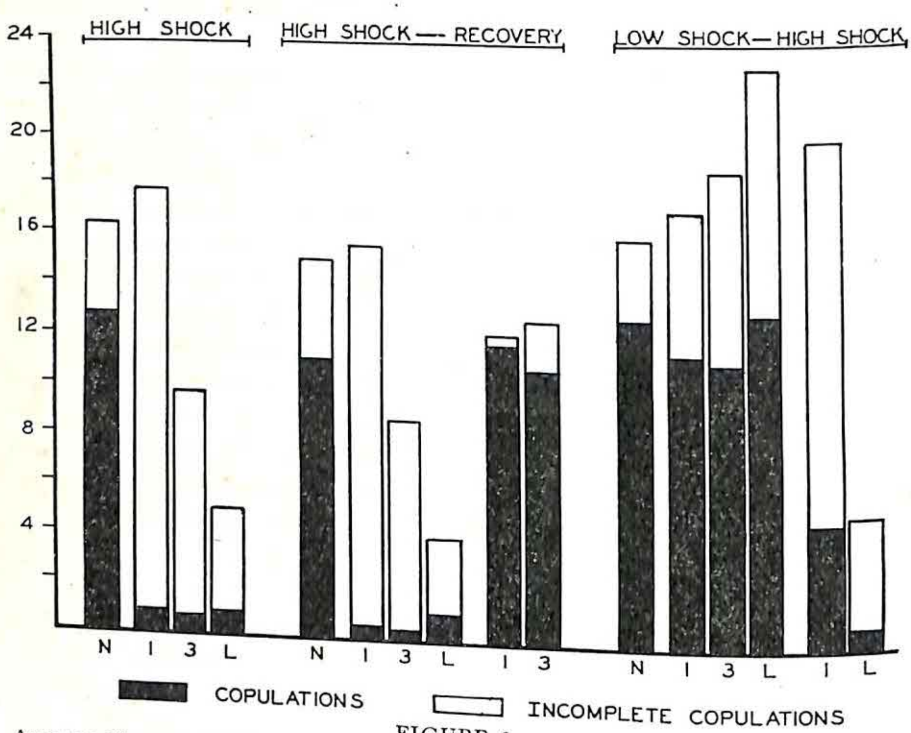

FIGURE 3

AVERAGE NUMBER OF MOUNTING RESPONSES AT DIFFERENT STAGES OF THE EXPERIMENT

The significance of the various symbols is as follows: N = normal (last test before shock); 1 and 3 = first and third tests under the specified condition; L = last test in which mounting reactions occurred under the specified condition.

shock. These accounted for 21 per cent of total mounts before shock and rose to 35 per cent in the first low shock test. Two tests later it was 41 per cent and in the last test under low shock 44 per cent of all mounts were incomplete.

The change from low to high shock reduced the frequency of total mounts with the result that on the last high shock test in which mounting occurred, its frequency was significantly below preshock levels ($p < .01$).

The effects of shock upon the ejaculatory response were primarily of an all-or-none nature. As noted above, ejaculation occurred only once in high shock test, although it almost invariably took place in tests given before shock began. The six rats in *HS* that resumed mating after the cessation of high shock ejaculated on the average 1.5 times in 36 preshock tests and 1.4 times in postshock tests following recovery. *LS* males exhibited an average of 1.5 ejaculations per test before, and 1.4 per test under low shock.

In the course of the low shock tests the number of copulations preceding the first ejaculation declined. During the final preshock tests the average number of copulations before ejaculation was 9.3. During the first, third, and final low shock test this figure was 9.2, 8.3 and 8.0 respectively. The difference between the last low shock and the preshock average is significant at the .05 level. At the same time the number of incomplete copulations increased, as we have seen, with the result that average value for total mounts preceding the first ejaculation was 12.1 before shock, 11.2 in the first, 12.9 in the third, and 14.2 in the last low shock test. The difference between the first and last of these scores is not significant, however.

3. *Time Measures*

Changes in the average delay between introduction of the receptive female and the male's first mating response (mount latency) are illustrated in Figure 4. There is no need to present preshock scores, since the mount latency on the first shock test reflects the male's reactivity prior to first application of the shock. In all tests the male was allowed one complete copulation before receiving any shocks. Figure 4 shows that the delay before mating was initiated increased progressively in *HS* males. During the last punishment test in which they mounted the female, these animals were very hesitant to initiate contact. Their average mount latency was 13 times longer than it had been in the first high shock test. This difference is significant at the .001 level. When sexual responsiveness returned spontaneously the frequencies of copulation and ejaculation were normal, but Figure 4 shows that in the first test the initial mount was as long as on the last punishment test. In subsequent tests mount latency grew shorter, and if testing had been continued it would probably have returned to preshock levels. The difference between the first and last recovery tests is significant at the .01 level.

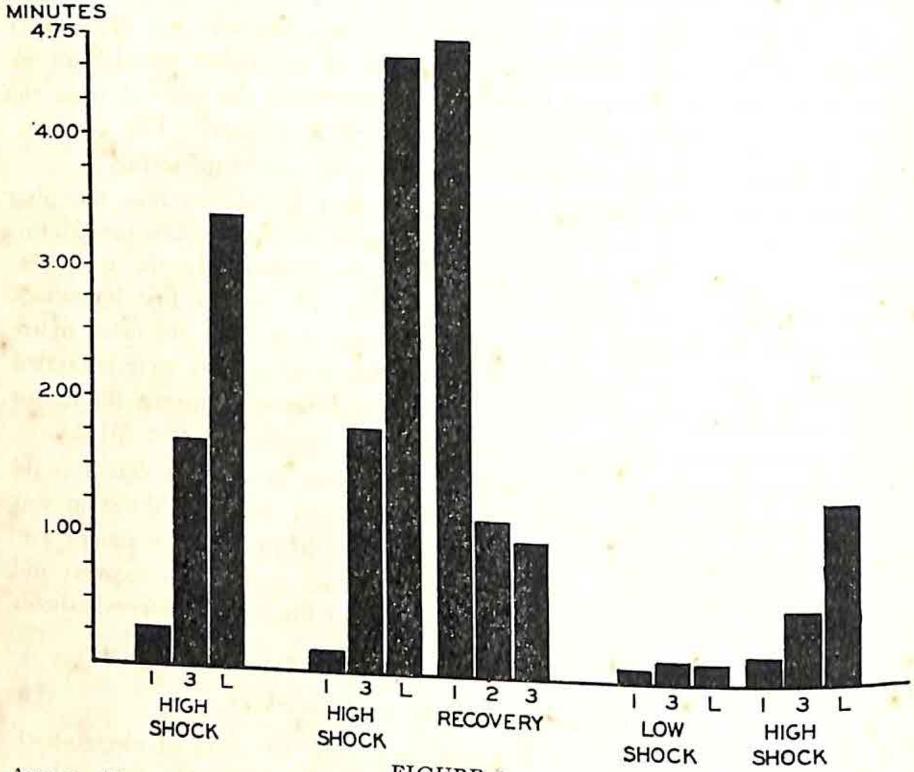

FIGURE 4
AVERAGE DELAY BEFORE THE MALE'S FIRST MOUNTING RESPONSE AT DIFFERENT STAGES OF THE EXPERIMENT: THE SIGNIFICANCE OF THE VARIOUS SYMBOLS IS AS IN FIGURE 3

Low shock produced no significant change in mount latency, but when *LS* males were exposed to high shock there followed a steady lengthening of the delay preceding mating. The difference between mount latency in the first and last mount-positive high shock tests was significant ($p < .01$).

It is apparent in Figure 4 that the average mount latency in the last high shock test was appreciably longer for *HS* than for *LS* males. This difference approaches significance ($.05 < p < .10$) using a difference between means test.

The time from a male's first copulation until the occurrence of ejaculation and the deposition of the vaginal plug is known as the plug latency.

This interval became progressively shorter during the low shock tests. On the last test before shock the average plug latency was 4.21 minutes. In the first, third, and last tests under low shock the mean plug latencies were 3.79, 3.26, and 3.14 minutes respectively. The decrease from the first to the last test was statistically significant ($p < .01$).

It will be recalled that the number of copulations was not appreciably affected by low shock, whereas the frequency of incomplete copulations increased steadily in successive tests. At the same time the interval from the first copulation to ejaculation grew progressively shorter. The combination of these two trends resulted in an accelerated rate of mounting.

Dividing the total mounts preceding the first ejaculation into the plug latency gives a measure of the average "intermount delay." Changes in this index to sexual activity can be summarized as follows. In the final preshock test the average delay was 0.36 minutes. During the first low shock test it was 0.29 minutes. In the third test under low shock the mean figure was 0.26 minutes; and in the final test of this series mounts were separated by an average interval of 0.21 minutes. The difference between the means of the preshock and the last low shock tests was significant ($p < .01$).

Ejaculation was so rare under high shock that intermount delays could only be calculated in terms of the entire test, and since test duration was constant such calculations tell us no more than do the data on mount frequency. However, the six *HS* males that showed spontaneous recovery did ejaculate in the recovery tests, and comparison of intermount intervals shows no change from the preshock performance level.

4. *Effects of Electroconvulsive Shock*

Seven males in Group *HS* and nine in Group *LS* received electroshock treatment at varying delays after the last high shock test. Of this total six rats had shown spontaneous recovery of sexual responsiveness by copulating in one or more tests between the cessation of high shock and the initiation of convulsive treatment. All of these animals continued to copulate and ejaculate after 12 electrically-induced convulsions. Four others were partially paralyzed by the repeated convulsions.

The remaining experimental subjects consisted of three males from Group *HS* and a like number from Group *LS*. These rats had reached the criterion of inhibition after 4 to 13 trials under high shock. From 22 to 106 days after the last test in which they had received a 380-volt shock, these males were observed in a "retention test" with a receptive female and none of them attempted to copulate. Three days later the first of 12 convulsive shocks was administered to three animals, while the other three were put through the same routine of handling and fastening metal clips to the ears but were not shocked. This procedure was repeated for 12 days and mating tests occurred after the 4th, 8th, and 12th treatments. The three shocked rats were then given three post-treatment tests at 4-day intervals, and at the same time the three control cases were subjected to 12 convulsive shocks while their testing continued as before. Following shock treatment this group received three final sex tests.

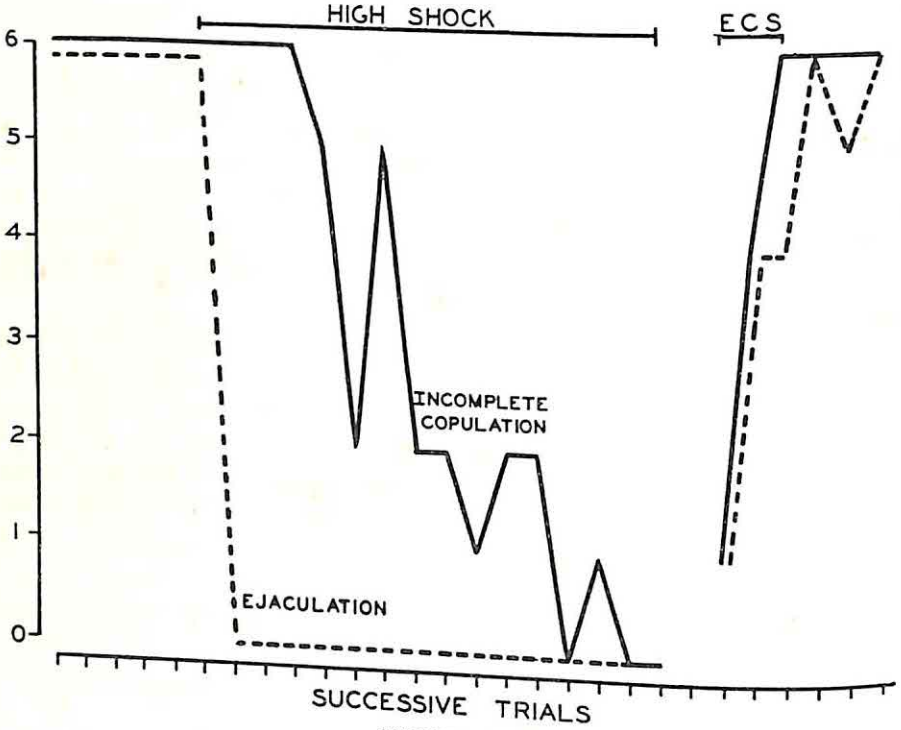

FIGURE 5
EFFECTS OF ELECTROCONVULSIVE SHOCK UPON EXPERIMENTALLY PRODUCED SEXUAL INHIBITION

The performance of these six animals during high shock punishment tests, and during electroshock and post-electroshock tests is presented in Figure 5. The figure is self explanatory. Strong punishment eliminated ejaculatory behavior immediately and produced a gradual reduction in the proportion of the group attempting to copulate. Eventually all males ceased showing mating responses. Under the influence of daily convulsive shocks copulatory and ejaculatory reactions reappeared, and in three post-treatment tests the group's performance was essentially the same as it had been before punishment began.

D. DISCUSSION

Four findings to be accounted for are (*a*) inhibition of mounting responses under high shock, (*b*) spontaneous recovery of mating reactions in two-thirds of the males in Group *HS*, (*c*) changes in sexual performance under low shock, and (*d*) restoration of mating activity in six males after electroconvulsive shock treatment.

1. *Reactions to High Shock*

The outstanding effect of high shock was the inhibition of mating reactions. The elimination of mounting responses probably reflected fear of contact with the female and may have represented a negative reaction to the test environment. The latter possibility is suggested by the fact that after a few tests under high shock some males repeatedly tried to jump out of the observation cage before the female was introduced and before any punishment had been administered.

High shock greatly reduced the frequency of intromissions and prevented the achievement of ejaculation in all but one test. It might therefore be argued that inhibition of mating reactions was due to absence of the normal reinforcing stimuli. This factor could have been operative, but we believe that its effects were relatively unimportant. Kagan (6) observed sexual activity of male rats which were allowed to attempt copulation with receptive females under conditions in which intromission was impossible. After 54 mating tests his subjects continued their attempts to copulate. In contrast, males in the present experiment ceased mounting the female after an average of fewer than 10 tests with high shock. We feel that the disappearance of mating reactions was due to the inhibiting effects of previous punishment.

An impressive indication of the strength of copulatory tendencies at the time that punishment was first introduced is seen in the fact that some of our males exhibited as many as 40 mounts during the first high shock test although each mount resulted in an obviously punishing shock. Furthermore, mating attempts continued in some cases for more than 10 observation periods before the avoidance tendency became strong enough to inhibit mounting. The growth of the avoidance tendency was reflected in the progressive increase in mount latency.

2. *Cases of Spontaneous Recovery*

In the majority of *HS* animals tested for recovery from the effects of high shock, the inhibiting effects of punishment were relatively short lived. Four of the nine animals recovered within two to four weeks after two to six tests without punishment. An additional four cases from Group *LS* were not tested systematically, but spot checks at irregular intervals revealed the reappearance of copulatory reactions from 39 to 73 days after the last high shock.

Just why some males recovered and others did not is not clear. There is some suggestion that rats which received more punishment in more tests were less likely to return to normal, but the evidence is far from conclusive. It may well be that in a less homogeneous population showing a greater range of individual differences in sexual responsiveness some relationship between reaction during the shock tests and the capacity for spontaneous recovery would become apparent.

3. *Reactions to Low Shock*

Although their behavior in a solitary situation showed that the males could feel the 100-volt shock, this degree of punishment did not produce sexual inhibition when associated with mounting behavior. Some animals endured as many as 250 separate shocks without showing any decline in mating reactions. The average number of low shocks received was 162. Members of Group *LS* continued to initiate sexual contact with minimal delay on each successive test. Average mount latencies showed no progressive change from the first to the last low shock test.

If it is assumed that the low shock was mildly painful or unpleasant, and evidence for this assumption is presented below, how is it possible to account for the failure of low shock to reduce or inhibit the behavior with which it was associated? Several factors undoubtedly were involved.

As noted earlier, the experimental animals were carefully selected for high sexual responsiveness. Males of average or below average sexual excitability might have been inhibited by the 100-volt shocks. In addition, each test began with an unpunished intromission, and this may have served to strengthen the tendency to copulate and to partly counteract any negative effect of previous punishment. There is also the possibility that the low shock was just strong enough to produce a state of excitement which, added to the effects of strictly sexual stimulation, enhanced rather than depressed the tendency to engage in mating reactions. It has been suggested that sexual and nonsexual excitement may summate under certain conditions and produce an increase in copulatory activity (1).

Although low shock did not eliminate mating responses, it was not without effect upon copulatory performance. One of the most clear-cut changes during the low shock tests was the progressive increase in the number of incomplete mounts. We believe that the increase in incomplete mounts reflected a partial avoidance tendency which grew progressively stronger as low shock tests continued. Association of mounting with the sensation of low shock may have caused the males to terminate some mounts prematurely and thus to have resulted in an increasing proportion of mounts without intromission. Increasing experience with the low shock may have resulted in more and more brief mounts in which the males attempted to execute sexual responses and still avoid punishment.

4. *Effects of Electroconvulsive Shock*

There are several possible explanations for the fact that six rats which had not displayed spontaneous recovery from the experimentally-induced sexual inhibition became active following a series of electroconvulsive shocks. The first is that the shocks were not responsible, and these animals would have returned to normal without special treatment. The hypothesis we reject on the basis of the finding that half of the group failed to recover during the control tests, while the other males which were receiving shock at the same time did resume mating. Subsequently the control group received shock treatment and became sexually active.

The second explanation is that the disappearance of sexual responses was due to a fear-motivated avoidance, and that the shock therapy acted to reduce fear (5). Persistence of mating behavior after shock therapy could be attributed to the fact that during the period of treatment all animals experienced full sexual activity and were thus stimulated to continue mating.

A final explanation is based upon the widely held belief that electroconvulsive shock tends to disrupt recently acquired habits without interfering with others of longer standing. It might be argued that the habit of avoiding contact with receptive females was a relatively new response which deteriorated under shock therapy, thus permitting reappearance of the older habits of copulating and ejaculating. The data from this experiment provide no basis for choice between the last two interpretations.

E. Summary

Nineteen male rats selected for high sexual responsiveness were observed in a series of mating tests with receptive females. Males wore a light harness which held an electrode against the skin of the back. The electrode was attached to a current source, and the metal floor of the observation cage served as the other point of contact. While he was in contact with a female the male could be exposed to an electric shock which did not reach the other animal.

After a series of adaptation tests the males were divided into two groups and in subsequent tests all subjects received an electric shock when they mounted the receptive female. In Group *LS* the shock consisted of 100 volts, *AC*. Members of Group *HS* received 380 volts each time they attempted copulation. Following a series of tests with 100-volt shock, males in the *LS* group were shifted to high shock and thenceforth received 380 volts each time they mounted the stimulus female.

In no instance did the 100-volt shock inhibit the tendency to mate. Under this degree of punishment all *LS* rats continued to copulate. They did exhibit a progressive increase in the frequency of incomplete copulatory attempts during successive tests under low shock. But the frequency of complete copulations with intromission was unchanged.

Under the influence of the high shock all rats in both groups eventually reached the criterion of sexual inhibition which consisted of two successive tests with no attempts to mount the female. When punishment was discontinued the majority of males recovered from the inhibited state and resumed mating within 12 to 30 days.

Six males that gave no indication of recovering spontaneously were subjected to a series of 12 electroconvulsive shocks. All of these animals were restored to normal levels of sexual performance by the shock treatment, and they continued to mate and ejaculate after treatment was discontinued.

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The Journal of Genetic Psychology, 1956, **89**, 183-197.

THE RELATIONSHIP OF PLACE AND TURN ALTERNATION TO REACTIVE INHIBITION*

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A. INTRODUCTION

A rat faced by a choice of paths for which it has no strong preferences tends to alternate choices on successive trials. This phenomenon, known as spontaneous alternation or alternation behavior, has been demonstrated on a variety of mazes and problem boxes.

An important difference among theories of alternation arises from the choice of definition of alternation. The alternation response can be defined in at least two ways. We may speak of the alternation of a turning response, defined with respect to the animal's body, as turning in a given direction. Or we may speak of the alternation of an approach response, defined as locomotion toward a particular external stimulus. These two definitions will be referred to as turn-alternation and place-alternation, respectively.

Solomon (8) and Zeaman and House (9) have attempted to explain alternation behavior as a result of reactive inhibition. They assumed that the turning response is temporarily inhibited after it has occurred, so that the response of turning in some other direction is temporarily stronger. Thus, turn alternation is predicted. Place alternation would be predicted if it were assumed that approach responses are affected by reactive inhibition.

Two more recent theories predict the alternation of approach responses. Montgomery (6, 7) postulates an exploratory drive which elicits investigation of unfamiliar stimuli and which is temporarily reduced by investigatory responses. Exploratory drive causes the rat to respond to the least familiar of the available paths of the maze. Glanzer (3) has presented a postulate set relating stimulus satiation to alternation behavior and other phenomena. Stimulus satiation is said to develop upon exposure to a stimulus and to reduce temporarily the animal's tendency to respond to that

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*Received in the Editorial Office on March 14, 1955.

[1] This article is based on a dissertation submitted to the Graduate School of the University of Connecticut in partial fulfillment of the requirements for the Ph.D. degree. The author wishes to express her appreciation to Dr. A. M. Liberman and the members of the committee for their many helpful suggestions and criticisms offered throughout the course of this experimental investigation.

stimulus. Glanzer also summarizes the literature with respect to these three theories.

In the usual *Y*- or *T*-maze, place and turn alternation cannot be separated, since the rat must make a different turning response to go to a different place. However, the two responses can be separated as Montgomery (7) and Rothkopf and Zeaman (8) have done by use of a reverse-*T* method. With this method, the direction of the *T* is reversed between trials by moving the starting arm from one side of the goal arms to the other. If the direction of the *T* is reversed after a left turn, the path previously chosen is then on the animal's right (Figure 1 illustrates this effect). The rat must then go to the same place to alternate the turning response or make the same turning response to go to a different place. The rat may place alternate or turn alternate, but not both.

Results obtained from the reverse-*T* method are conflicting. Montgomery (7) found that when the *T* was not reversed between successive trials, 75 per cent of the group alternated. When the *T* was reversed between trials, about 75 per cent of the group alternated places. It was concluded that spontaneous alternation is a tendency to alternate places. Data from Rothkopf and Zeaman (8), however, indicate that place alternation tendency may not account for all the alternation that occurs. They used forced trials to vary the number of successive responses to one arm of the *T*-maze from one to 10. When the *T* was not reversed for the alternation test trial, alternation increased from 75 per cent after one forced trial to 92 per cent after 10 forced trials. When the *T* was reversed for the alternation test trial, 51 per cent of the group alternated places after one forced trial and 31 per cent alternated places after 10 forced trials. This indicates a growing tendency to turn-alternate as numbers of responses to one side are increased. The discrepancy between the 51 per cent place alternation after one response and Montgomery's finding of 75 per cent place alternation after one response is probably related to the complex training history of the rats in the Rothkopf and Zeaman study. But it is clear that both place and turn alternation may occur.

The evidence for two kinds of alternation leads to the question of whether a single-factor explanation can account for all alternation phenomena or whether a different explanation must be used for turn alternation than for place alternation. The answer to this question depends in part upon how the two tendencies, place and turn alternation, are affected by the variables which affect alternation. If the two tendencies are widely different functions of any of these variables, then a two-factor explanation may be required. If, however, they are affected in the same way by the alternation variables, a single-factor explanation is preferable for its simplicity.

The present study undertakes to compare the relationship between place and turn alternation tendency for two of these variables, number of forced trials to one arm of the *T*, and duration of rest interval between forced trials and the test trial on the full *T*. This is to be done by comparing alternation percentages when the *T* is reversed for the test trial and when the *T* is not reversed. This procedure will provide two functions in which turn alternation tendency and place alternation tendency combine in two different ways. In the case when the *T* is not reversed, the two tendencies summate in some fashion. In the case when the *T* is reversed, the two tendencies are in conflict. It should be possible to make inferences about the growth and decay of the single tendencies by comparing performance under these two conditions.

In addition, an attempt will be made to check these inferences by a new method for studying place and turn alternation, to be called the run-out effect. In the run-out situation, the rat will be given a certain number of forced trials and then allowed free trials on the complete *T* until a response to the forced side is made. As the rat continues to run to the non-forced side, alternation tendency to go to the forced side is being built up. At the same time alternation tendency to the non-forced side decays with time. Run-out tests will be made with the reversed-*T* and the non-reversed-*T*. An attempt will be made to predict how many times the rat will go to the non-forced side. It should be possible to predict what will happen when the growth and decay processes take place simultaneously from the inferences made when they occur separately.

B. APPARATUS

The apparatus was an elevated single-*T* maze constructed of boards 6 inches high with a running path 1½ inches wide. The starting arm was 20 inches long and the goal arms 36 inches long. To make the various parts distinct, the starting arm was painted a neutral gray, one goal arm was painted white, and the other goal arm was painted black and covered with wire screening. The maze was set up on a table surrounded by cheese cloth curtains, which served as a one-way screen when illuminated from within.

Each of the maze units could be removed. The following alterations were made during the course of the experiment. (*a*) The starting arm was placed on either side of the goal arms, but always remained at right angles to them. (*b*) Either of the two goal arms was removed for forced trials, but was always replaced in the same spot. The four *L*-shaped mazes thus formed may be called left white, left black, right white, and right black if each is designated by the direction of the turn and the goal arm color. The term "regular *T*" will refer to the situation in which the starting arm remains in the same position for the test trial as for the forced trials on the *L*-maze. The term "reverse *T*" will be used when the starting arm is moved to the other side between trials on the *L*-maze and the test trial on the full *T*. Figure 1 illustrates the various maze positions used throughout the experiment.

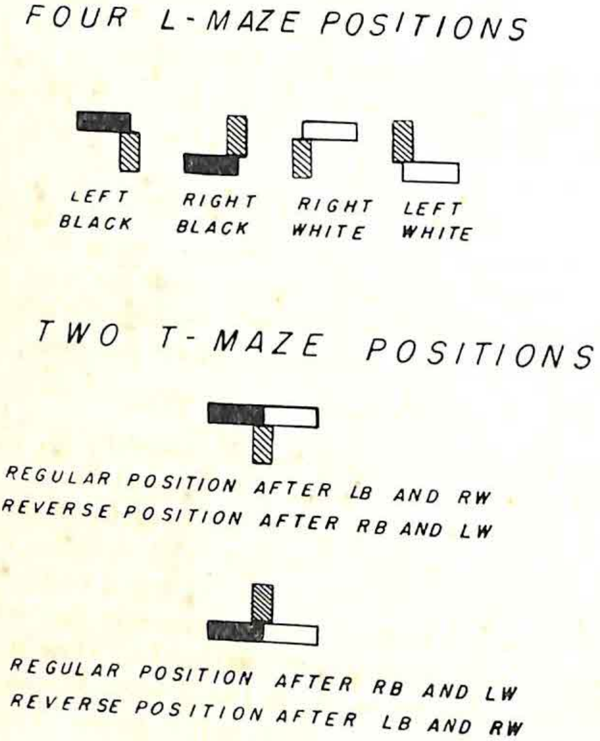
FOUR L-MAZE POSITIONS
LEFT BLACK
RIGHT BLACK
RIGHT WHITE
LEFT WHITE
TWO T-MAZE POSITIONS
REGULAR POSITION AFTER LB AND RW
REVERSE POSITION AFTER RB AND LW
REGULAR POSITION AFTER RB AND LW
REVERSE POSITION AFTER LB AND RW

FIGURE 1
A Diagram of the Maze Positions

C. Subjects and Procedure

The subjects were 13 male and 15 female white rats from the University of Connecticut colony. They were approximately six months old at the beginning of the experiment.

1. *Training and Motivation*

Since differences in habit strength for the two arms of the *T* may interfere with alternation, an attempt was made to keep habit strength equal. This was done by training the running response on all four *L*-maze positions to the asymptote of running time before collecting alternation data. Fifty trials were given on each of the four *L*-mazes. From one to 10 trials with 10-sec. spacing were given on a single day, all on the same *L*-maze position. During a block of four days, all four *L*-maze positions were presented in a random order. Reward for all trials throughout the experiment was access to wet mash for five sec. The rats were fed once a day after the day's trials. Wet mash was available at this time for 30 min.

2. *Alternation Practice Trials*

Alternation percentage increases with practice during the first few alternation trials. For this reason experimental conditions were held constant until after alternation percentage had ceased to change. Only the data collected after the practice effect had disappeared are presented.

3. *Number of Forced Trials*

In testing for the effect of varying number of forced trials, a certain number of forced trials at 10-sec. spacing was followed after a 15-sec. delay interval by one trial on the full *T*. The number of forced trials on a given day was one, two, five, or ten. Four tests were made on the regular-*T* and four on the reverse-*T* for each number of forced trials. The number of forced trials was held constant for eight successive days while the four tests were made on both the regular and reverse *T*s. These four tests were made after forced trials to each of the four *L*-maze positions. The two *T*-maze positions were presented in counter-balanced order during these eight trials.

4. *Delay Period between Test Trial and Forced Trials*

Length of delay period was varied after 10 forced trials at 10-sec. spacing for both the regular- and reverse-*T*s. The percentage alternation after a delay of 15 sec. was taken from the tests described above under *Number of forced trials*. Then a series of tests was made after 30 min., 60 min., and 4 hr. During each series, delay period was held constant for eight successive days while four tests on both the regular- and reverse-*T*s were made, after forced trials to each of the four *L*-maze positions. The two *T*-maze positions were presented in counter-balanced order during these eight tests.

5. *Run-Out*

The term "run-out" is used to describe the procedure of allowing rats to continue test trials on the full *T* (after the forced trials to one side) until a response to the forced side is made. An animal was stopped after a response to the forced side or after 10 successive responses to the non-forced side. Four run-out tests on the regular-*T* and four on the reverse-*T* were given. These tests were made after 10 forced trials. The four tests were made after forced trials to each of the four *L*-maze positions.

6. *Measures*

On the regular-*T* the percentage of the group alternating will be referred to as "total alternation." On the reverse-*T* the percentage of the group alternating places will be called "place alternation." Where means of several tests for the group are presented, each mean is obtained from an equal number of tests after forced trials to each of the four *L*-maze positions.

D. Results

Figure 2 shows that both total and place alternation percentages are direct functions of number of forced trials to one side, although place alternation rises only slightly after one forced trial. Although no measurements were made after zero forced trials, an empirical point there would necessarily be

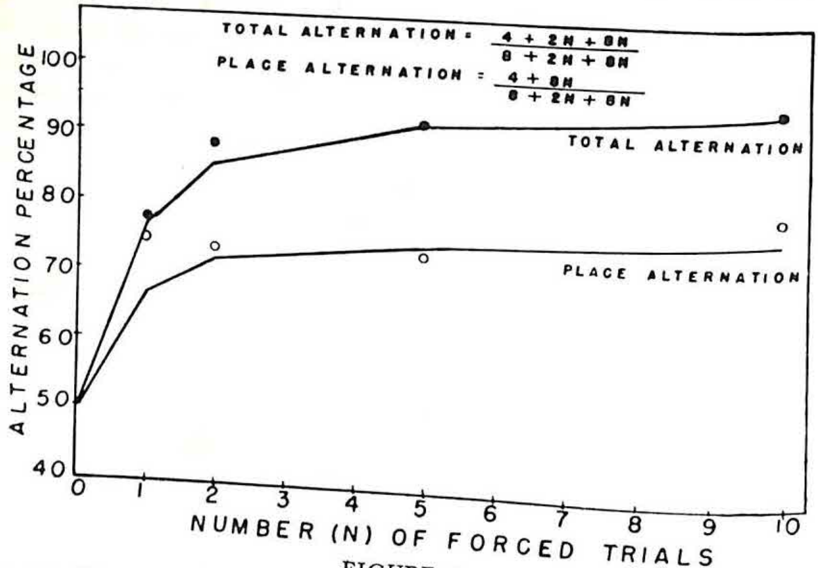

FIGURE 2

Place and Total Alternation as a Function of the Number of Forced Trials close to 50 per cent for both total and place alternation. In making such a measurement, an arbitrary reference side would have to be chosen in order to score responses as alternations or non-alternations. To be consistent with the measurements at the other points, each of the four *L*-maze positions must be chosen as arbitrary reference an equal number of times. It is clear that chance responses would be scored as alternations about 50 per cent of the time under these circumstances. But if a rat responds on the basis of a position preference, all left turns, for example, his alternation percentage will also be 50 per cent since half the time the arbitrary reference will include a forced right turn. A similar analysis can be made for place preferences.

Total alternation percentage is higher than place alternation percentage beyond the .01 level of confidence for every number of forced trials except one. There is no significant difference after one forced trial. Considering total alternation, alternation percentage is higher after two, five, and 10 forced trials than after one forced trial beyond the .01 level of confidence. There is no significant rise in place alternation after one forced trial. An exact statistical test described by Fisher (2, Sec. 21) was used to determine the significance of differences.

1. *Delay Period between Forced Trials and Test Trial*

Figure 3 shows that both place and total alternation decrease with time since the last forced trial and that total alternation remains higher than place alternation for at least four hours. Total alternation is significantly higher than place alternation for each time interval beyond the .01 level of confidence. All alternation percentages are significantly higher than 50 per cent except for the 4-hr. point for place alternation.

2. *Run-Out*

In Figures 4 and 5 are shown the results of the run-out tests. Figure 4 shows the results for the regular-*T*. The rats were forced 10 times to one arm of the *T* and then allowed to respond on the full *T* until a response to the forced arm was made. The run-out percentage shows how many rats were still alternating to the non-forced side after a given number of successive alternation test trials. This percentage decreases when rats make responses to the forced side and are dropped from the group. Figure 5 shows the same information for place alternation on the reverse-*T*.

3. *Theoretical Curves*

The theoretical curves shown in the four figures are derived in the discussion section. They do not represent attempts to find best-fitting curves, but rather to discover how closely certain assumptions can approximate the data. The deviations from the theoretical curves are discussed later.

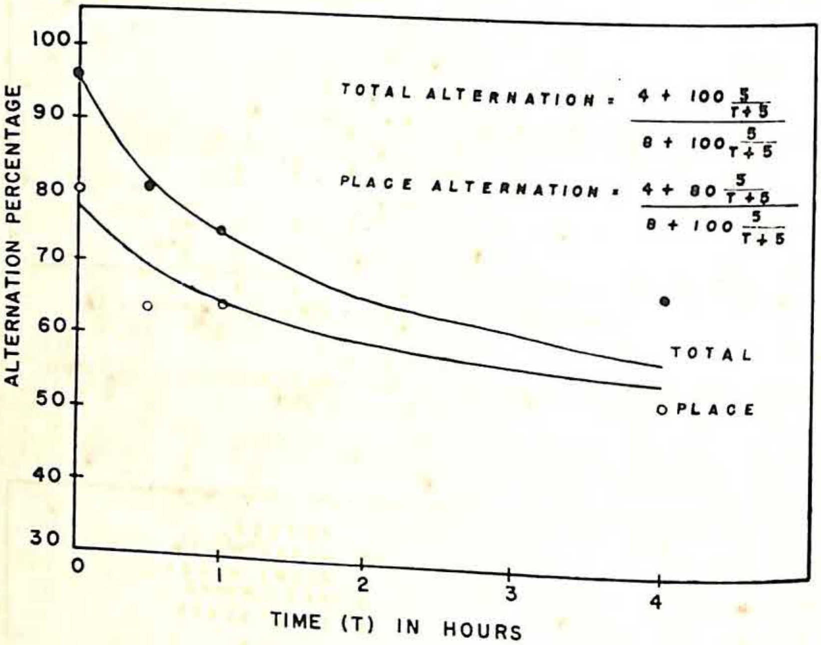

FIGURE 3

Place Alternation Compared With Total Alternation as a Function of Length of Delay Interval

E. Discussion

The results show that both total and place alternation percentages vary with number of forced trials and length of time between forced trials and test trial. Neither of these percentages is a pure measure of place-alternation tendency or turn-alternation tendency. On the regular-*T* either a tendency to place-alternate or a tendency to turn-alternate will result in an alternation response. Total alternation percentage is some measure of the sum of these two tendencies. But place alternation percentage does not represent the tendency to place-alternate in an absolute sense. The rat may place-alternate on the reverse-*T* even though some degree of turn-

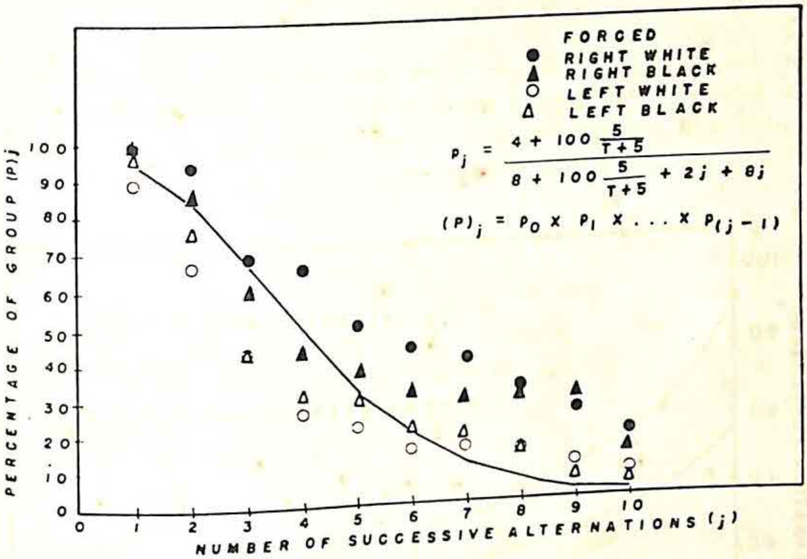

FIGURE 4
NUMBER OF SUCCESSIVE RESPONSES TO THE NON-FORCED SIDE AFTER 10 FORCED TRIALS ON THE REGULAR *T*

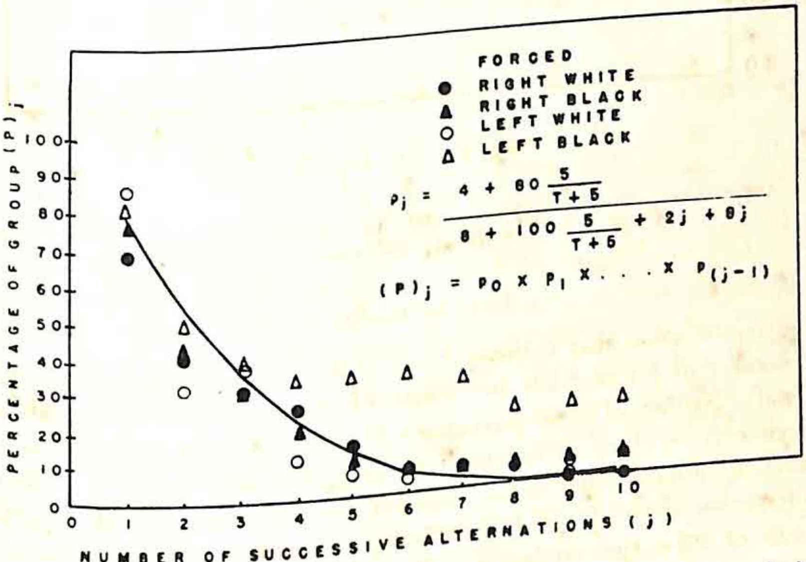

FIGURE 5
NUMBER OF SUCCESSIVE RESPONSES TO THE NON-FORCED PLACE ON THE REVERSE *T* AFTER 10 FORCED TRIALS

alternation tendency may be present. What has been called place alternation percentage is some measure of the relative strength of place-alternation tendency and turn-alternation tendency. In order to make inferences as to the growth and decay of either of the two tendencies alone, the rules by which they combine must be given. One such set of rules in the form of a probability model is described below. For reasons of simplicity, it was assumed that alternation is produced by a single factor, although we do not, for the present, attempt to identify it.

Four possible responses or outcomes of a trial are defined. These are (L) a left turn at the choice point, (R) a right turn at the choice point, (W) an approach response to the white arm of the T, and (B) an approach response to the black arm of the T. It is assumed that the rat makes only one of these responses on a given trial, although it is not always possible to identify it. For example, an approach response (B) to the black arm of the T may not be distinguishable from a left turn (L) at the choice point. However, the percentage of these ambiguous responses may be predicted.

An alternation test trial is regarded as analogous to drawing a slip of paper from a box containing many slips, each with an L, an R, a B, or a W written on it. The probability of drawing an L, for example, will depend upon the proportion of slips in the box marked L. The problem of predicting what response a rat will make is formulated as the problem of determining the proportional amounts of L, R, B, and W slips in the hypothetical box.

With equal habit strength for all responses and with no recent responses to either side of the T, it is assumed that there are an equal number of each kind of slip. If a left turn to the black side is used arbitrarily as a reference, then drawing either an R or a W slip would result in an alternation on the regular-T. On the reverse-T either an L or a W slip would result in place alternation. Since there are an equal number of each kind of slip, the proportion of Rs plus Ws or of Ls plus Ws to the total number of slips is one-half, and the alternation percentage should be 50 per cent.

If $L = R = B = W$ is equal to some number (S) of starting elements, then the probability fractions for both place and total alternation is $\frac{2S}{4S}$. We assume that each response to one arm of the T adds a constant number of alternation responses (or slips of paper to the box) for place- and turn-alternation tendency. For example, a response to left black would add a certain number (r) of right turns (R) and a certain number (w) of approach responses to the white side (*W*). After *n* responses to the left black, the probability of an alternation on the regular-*T* would be

$$p_T = \frac{2S + nr + nw}{4S + nr + nw}$$

and the probability of a place alternation on the reverse-*T* would be

$$p_P = \frac{2S + nw}{4S + nr + nw}$$

The same reasoning applies when the rat is forced to another position except that different response categories are being added. According to these functions, place alternation must always be less than total alternation unless *nr* is zero. Both functions are negatively accelerated, total alternation approaching 1 as an asymptote, and place alternation approaching $\frac{w}{r + w}$ as an asymptote. Place alternation may increase, decrease, or remain the same as forced trials are increased, depending upon the relative size of *w* and *r*. If *w* is greater than *r*, place alternation will increase with *n*. If *r* is greater than *w*, place alternation will decrease with *n*. If *w* equals *r*, place alternation remains at 50 per cent regardless of number of forced trials.

Accounting for the decay of alternation tendency in terms of our probability model means allowing for the removal of the added elements from the box in some fashion. We assume that only the added elements are removed, that the starting elements remain constant. An assumption that the added elements are removed linearly, that is, a constant number per unit time, was found to give results inconsistent with the data. Removal of elements according to an exponential function also proved inadequate. A fair description of the data was obtained by letting the number of elements left after a given time bear an inverse relationship to time. This necessitates the addition of a single parameter *k* to the probability fraction in order to express the decay of alternation. We also assume that both place and turn alternation tendencies decay at the same rate. Total alternation as a function of time is described by the following expression.

$$p_T = \frac{2S + n(r + w)\dfrac{k}{T + k}}{4S + n(r + w)\dfrac{k}{T + k}}$$

Place alternation is described by the following expression.

$$p_P = \frac{2S + nw \dfrac{k}{T + k}}{4S + n(r + w) \dfrac{k}{T + k}}$$

The symbol T refers to time since the last forced response. When T equals zero, these expressions reduce to the corresponding expressions for the growth function. As T increases, the fraction of elements remaining decreases, approaching zero as an asymptote.

The theoretical curves of Figures 2 and 3 are the result of assigning values to S, r, w, and k. Only a rough description of the data is thus obtained. However, the model may be further tested by using these same constants to predict the results of the run-out procedure. This requires no additional parameters.

Let p_j refer to the probability of alternation from the forced side after j alternation responses have occurred. This probability may be expressed as follows if the rat has been forced to left black.

$$p_j = \frac{2S + n(r + w) \dfrac{k}{T + k}}{4S + n(r + w) \dfrac{k}{T + k} + jl + jb}$$

This expression allows for the decay of tendency to alternate to the right white at the same time that alternation elements for alternation to the left black are being added to the total number of elements present. In the expression l is equal to the value previously assigned to r, and b is equal to w. T, again, is time since the last forced response. The corresponding expression for place alternation is as follows:

$$p_j = \frac{2S + nw \dfrac{k}{T + k}}{4S + n(r + w) \dfrac{k}{T + k} + jl + jb}$$

These expressions predict the percentage of those animals which have already alternated j times from the forced side which will alternate again on the (j + 1)th trial. To predict how many animals in the group will still be alternating on the jth trial, $(P)_j$ probabilities are multiplied for p_0, p_1, p_2, etc.

$$(P)_j = p_0 \times p_1 \times p_2 \times \cdots \times p_{(j-1)}$$

This formula applies only if each rat's test trial may be considered as a random drawing from the hypothetical box of response categories. To the extent that rats have position preferences, this is a poor assumption. We would expect more short runs and more long runs than predicted from rats which have been forced to their preferred sides and to their non-preferred sides, respectively.

Values for $(P)_j$ were computed for j equal to one to ten, using the same constants as for the growth and decay curves. As may be seen from Figures 4 and 5, deviations of the empirical points from the theoretical curves are fairly large. However, they are consistent with our analysis of the effect of position habits. For example, in Figure 4, most of the filled-in points, which represent alternations to the left, fall above the theoretical curve. This shows that more rats made long runs of alternations to the left than predicted. When the rats were forced left, however, more rats dropped out after two or three alternations to the right than were expected, as indicated by the fact that the open points fall below the theoretical curve during the early alternation tests. A similar analysis may be made for Figure 5. Examination of the individual data shows that, in general, those rats which made long runs of left or right were among the first to drop out when they were forced to their preferred sides. These results probably indicate that a small amount of alternation tendency may be insufficient to overcome position preferences. In terms of the model, these rats may have an unequal distribution of starting elements. The number of *L*s, for example, in the equation may be greater than the number of any other type of response. As a result, a considerable number of added *R* elements would have to be present in order to balance this difference. If a correction were made for the individual rats according to degree of preference, greater accuracy of prediction might be possible. This degree of preference can be determined independently of the alternation tests by allowing free choices on the *T*-maze without previous forced trials. We may conclude that although the behavior of the group as whole can be predicted by assuming that each rat is a random selector of responses, the bias of each rat must be taken into account to predict the behavior of individuals in the group.

We have shown that a one-factor model is fairly successful in predicting the data obtained in this experiment. We infer a single factor because of the assumption of the model that both place-alternation tendency and turn-alternation tendency grow and decay according to the same laws.

An attempt should be made to identify this single factor with some construct which accounts for other kinds of behavior, if alternation data are to be subsumed under general psychological laws. According to Hull's postulate IX (4, p. 9), reactive inhibition is produced by the evocation of any reaction. Thus, a reactive inhibition theory could predict the occurrence of both place-alternation and turn-alternation, if a reaction is defined both as an approach to an external stimulus and as turning in a given direction. The relationship between reactive inhibition and alternation percentage which would allow quantitative predictions to be made has yet to be developed. But the qualitative aspects of the data could be accounted for by assuming that both approach responses and turning responses are affected by reactive inhibition.

The effect of reactive inhibition on a response for which no molecular description can be given is not peculiar to alternation. The approach response as defined here is analogous to a pursuit response defined for the pursuit rotor without reference to the muscles used in that response. That such a concept may be necessary is indicated by a study by Kimble (5). Subjects were practiced on a pursuit rotor with the right hand. Following this practice, half the subjects were given a short rest before a practice session with the left hand. The remainder of the subjects began to practice with the left hand immediately. The rested subjects performed better than the non-rested subjects on the left-handed practice. This improvement, in Hull's system, is a measure of the reactive inhibition lost during the rest period. Reactive inhibition, in this case, cannot be referred to a particular set of muscles. Definition of the response which was affected by reactive inhibition can be made only with reference to the external stimuli, as for the approach response in the present study.

Both exploratory drive and stimulus satiation theory would predict only place-alternation. However, Berlyne (1) has pointed out that the phenomena of stimulus satiation may be derived from reactive inhibition theory through the fatiguing of perceptual responses. The view that place-alternation is the result of stimulus satiation as elaborated by Glanzer (3), but that stimulus satiation is, in turn, a function of reactive inhibition of perceptual responses, is quite consistent with the present finding that both place- and turn-alternation may follow the same laws.

F. SUMMARY

A comparison has been made between alternation percentage on a single-T maze and place alternation percentage when the single-T maze is reversed in direction for the alternation test trials. Number of forced trials to one side before the test trial and delay period between 10 forced trials and the test trial were varied. It was found that rats tend both to alternate turns and to alternate places. A probability model which assumed that both place-alternation and turn-alternation follow the same laws was applied to the data. In addition, constants obtained from fitting the theoretical curves to the above data were used to predict how many times rats would continue running to the non-forced side of the T if successive alternation test trials were given. It was concluded that a one-factor explanation for alternation phenomena is feasible and arguments in favor of identifying that factor as reactive inhibition were presented.

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The Journal of Genetic Psychology, 1956, **89**, 199-212.

PATTERNS OF AGGRESSION IN PARENTS AND THEIR CHILDREN* †

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A. RESEARCH OBJECTIVE

This paper presents a first report of a study designed to explore the relationship between patterns of aggression in children and such patterns in their parents. Implied in the approach adopted in this study are the following minimal assumptions: (*a*) Any person may be regarded as having a characteristic intra-personal organization of aggression. Such an assumption is consistent with the more general view that any individual may be seen as having a characteristic personality organization. It is at the same time consistent with the assumption that there are various degrees and kinds of communalities of organization among persons. (*b*) Since children are born without personalities[1] but develop them in the course of prolonged social relationships with parents who have personalities, it is useful to examine the relationship between parental personalities and those of their children. It is likewise of value to study the two generations in terms of any given aspect or "area" of personality, such as aggression is here conceived to be.

It is not denied, of course, that aggressive feeling and expression differ from time to time within the same individual. The point of view presented here assumes only that, surveying all these variations, it is possible to make useful statements about general propensities which differentiate individuals from one another. Similarly, many aspects of parental behavior may contribute to the quality of aggression in their children. Added understanding may come from inquiring into the relation between children's aggression patterns and those of their parents.

Aggression, then, is here considered as a component of personality. In

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*Received in the Editorial Office on April 12, 1955.

†This paper is an initial report of one phase of a project initiated with the assistance of a grant from the Social Science Research Committee of The University of Chicago. Subsequently this investigation was supported in part by a research grant (M 543) from the National Institute of Mental Health, of the National Institutes of Health, Public Health Service.

[1] Though they are born with characteristic "temperamental" differences—such as activity rates and sensitivities.

children, it is assumed to vary with this component in their parents. This perspective differs from, but is not necessarily inconsistent with, that assumed in many other studies of aggression. Two of the most general of these perspectives have been cited by Kris:

> Two general assumptions as to the nature of aggressive impulses are usually contrasted; both are derived from the work of Freud, who emphasized both at different times and in different theoretical contexts. According to the older of these views, aggressive impulses (defined here, in agreement with recent writers, as impulses intended to damage an organism or its substitute) arise in reaction to other experiences; according to the second assumption, human beings are equipped with an independent aggressive drive.
>
> The first view gained wide acceptance through the extensive studies made on the relation of frustration and aggression (5, p. 146).

The Yale group's frustration-aggression theory is oriented to discovering the characteristics of *situations* which induce frustrations and hence instigate to aggression, and, more importantly, the *conditions* within the individual that influence the release and direction of aggression. Although this line of investigation is compatible with the point of view of the present study,[2] structural differences between people are not made the focus of attention in the frustration-aggression study. The hypotheses are generally such that *any* group of subjects is as suitable as any other for testing them.

A rather different starting point is taken in many psychoanalytic writings on aggression. In an important recent example, an original and distinctive aggressive energy is postulated (4). This energy, designated "aggression," is considered to be coördinate with libido, and the vicissitudes of the former are explored in terms analogous to those customarily used in describing the latter. There is, in other words, an "aggression economy" just as there is a "libidinal economy." Now while the Yale group explicitly disavows any assumption regarding the genetic status of aggression, many of the specific problems to which their work is addressed can be readily conceptualized in "economic" terms. They do not do so, and for many problems it is not necessary to take a stand on this issue. Indeed, Kris, in the chapter cited, goes on to state that if frustration is defined to include "experiences provoking insecurity or anxiety in general . . . the first and the second set of assumptions concerning the nature of aggressive impulses need no longer be differentiated for many types of investigation" (5). That this is so is further indicated by the fact that a phenomenon such as displacement of aggression is recognized in both points of view discussed here, though its conceptual base is different in the two systems of explanation.

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[2] Note for example: "As a result of his life history, any given person will carry into adult life a high or low ability to 'tolerate' frustrations and will stand at some point on a dimension of 'readiness' to be aggressive in frustration situations . . ." (3, p. 88).

For the purpose of the present study, no assumption is made as to whether there is or is not an innate aggressive drive. A sufficient starting point is provided with the observation that everyone has aggressive impulses and feelings and that "Every individual learns to deal with his hostile imimpulses . . . and the ways of handling hostile feelings in relation to the environment become a qualifying individual characteristic" (1, p. 89). The next task, then, is to present a relevant conceptualization on the basis of which individual patterns may be compared.

B. A CONCEPTUALIZATION OF AGGRESSION[3]

Aggression is here defined as the conscious or unconscious intent to attack, injure, or harm an object. Three broad aspects of aggressive structure in the individual are distinguished; each aspect comprises several variables. *Mobilization* of aggression refers to the pattern of aggressive affect and impulse. *Ego functions* refer to how the individual handles the affect, including how he "places" aggression in his ego, how he releases aggression, and where he directs it. *Sequellae*[4] refers to the intrapsychic consequences of the aggression and its release. The specific variables included in the present research are:

Mobilization

1. Intensity of aggressive affect (a continuum ranging from "feelings of annoyance" to "feelings of fury and rage").
2. Threshold of arousal (how readily aggressive feelings become mobilized).
3. Duration of aggressive feeling (tendency of aggressive feelings to persist through time).

Ego Functions

A. *Integrative*

4. Awareness of own aggressive feelings (limited to conscious or preconscious awareness).
5. Acceptance of own aggressive feelings (a measure of the extent of the defensive operations against aggressive feelings, extent to which they are ego-alien or ego-syntonic).

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[3] James C. Abegglen was associated with the writers in the development of an earlier version of this conceptual scheme.

[4] This term is used by David M. Levy to refer to "the events following the attack on the object." It is regarded as a point in the structure of the hostile *act*. We have given it a more generalized meaning as a characteristic aspect of persons (6).

6. Perception of self as object of others' aggression (extent to which the person feels others to be hostile or attacking toward him).

B. Executive

7. Reaction time (how quickly the individual's aggression gains overt expression).

8. Extent of overt expression of aggression (how much of the person's aggression finds some form of overt expression).

9. Intent to disguise aggression (extent of the individual's wish to conceal his aggressive expressions).

10. Manner of expression of aggression (an appraisal of the restraint or violence of aggressive expression).

11. Extrapunitive tendency (extent to which the person directs his aggressive feelings to external objects).

12. Intrapunitive tendency (extent to which the person turns his feelings against himself).

13. Displacement (tendency to direct aggression to objects other than those toward whom it is originally felt).

14. Fantasy (extent to which aggressive feeling is channeled into fantasy as accompaniment of or substitute for overt aggressive activity).

Sequellae

15. Guilt over aggression (how much guilt is experienced over aggressive impulses and feelings).

16. Anxiety over aggression (how much anxiety is experienced over aggressive impulses and feelings).

17. Maintenance of ego integration and effectiveness (appraisal of extent to which aggressive feelings and/or defenses against them permit continued effective functioning).

Several comments are unquestionably in order regarding this scheme. First, it is not claimed that these variables refer to phenomena which can theoretically vary completely independently from one another. The content of some overlaps with that of others. On the other hand, each may vary with some degree of independence from the others. Secondly, many important aspects of an individual's aggression pattern that one would want to know about are not included. Certain omissions are immediately apparent. For example, the individual's characteristic targets are not a part of this scheme. Nor is there an assessment of the dynamic origin of the aggression, e.g., whether it is primary or defensive, whether it is sadistic or counter-phobic or paranoid in quality. These aspects have not been included in the present analysis primarily because of the added complications they would introduce, and not because they are considered to be unimportant.

An analysis of what might be termed an individual's personal style of aggression also has not been given systematic attention. Many kinds of verbal aggression, for instance, are distinguished by terms which allude metaphorically to physical destruction or attack. Making "cutting" remarks or "biting" criticism are behaviors which are perceived to be different from "slashing someone to ribbons"—which in turn can be distinguished from the provocative behavior called "needling." The analysis of phenomena of this kind would require a different type of procedure from that adopted in the present study.

C. SUBJECTS

The overall project, of which this study of aggression is a part, is directed to examining some of the psychological relationships within families. Three major criteria were established for selection of subjects: (*a*) The families should *not* be selected from a clinic population; (*b*) only those families should be included from whom it would be possible to obtain data from all members falling within the specifications of the sample; and (*c*) all children in the study should be biological offspring of the parents with whom they live—none should be adopted. The principal further specification was that the sample consist of families with either two or three children between the ages of six and 18. If the family included children younger than six, these were not to be studied because of the necessity of using other kinds of techniques for obtaining data. More importantly, children of six and older may be considered to have formed personalities in a meaningful sense, though the extent to which these personalities will be altered with further development is admittedly an open question. In an effort further to limit variability, it was decided to confine the sample to families of north and west European origin. Our parent subjects were either to be American-born or to have been brought to this country in early childhood. Socially distinguishable ethnic families were not to be included. The sample was to be approximately equally divided between a lower and a higher socio-economic group.

These are admittedly very broad limits for sample composition. Yet the difficulties of meeting even such requirements proved formidable, in the absence of a readily available means of access to families of the age and size composition desired. In the most general terms, our aim was to gain psychological information concerning families who belong to the core culture as it is found in an urban setting (7). For this purpose, the criteria and specifications seemed appropriate. Although ideally it might have been desirable to confine the choice of child subjects to a narrower age range, this was not feasible within the limitations of time and resources available. In view of the procedure adopted for treating the data (described below), the age-spread is not considered to be a serious drawback.

The present paper reports upon some of the findings obtained from the first group of 10 families studied.[5] Access to these families was gained through a variety of sources. Some were obtained from the rolls of a neighborhood boys' club, some through a church, and some through families studied earlier in the sequence. The fathers range in age from 34 to 57, the median age being 44. The mothers' ages range from 34 to 45, with the median at 40. There are 26 children in this group: eight girls ranging from six to 12 years of age and 18 boys covering the span from seven to 18. Six of the 10 families have three children within our age group (in addition one has an infant); four families have two children of appropriate age—two of these have infants. Three of these families are roughly of upper-middle class status, the husband's occupation being either highly skilled professional or well-placed junior executive. The other seven belong to what Warner terms the "common-man level," the husband's occupations ranging in skill and prestige from chauffeur and shipping-clerk to electrician and foreman in a small manufacturing plant. All but two of the 20 parents were born in the United States; one was born in the Far East of American missionary parents, and one was born in Scandinavia. Both of the latter were brought to this country as young children. One family is Roman Catholic in religious affiliation, one is Christian Scientist; the other eight have various Protestant affiliations—though actual participation ranges from almost none to active church membership.

D. Data and Procedures

From each of the 46 individuals studied, three instruments were obtained: an interview, a *TAT*, and a Sentence Completion. All interviewing and testing took place in the homes of the subjects. The field workers insisted on privacy so as to maximize freedom of response and minimize tendencies toward conformity that might occur as a response to the study situation itself.

The basic operation in the treatment of the data was the rating on an eight-point scale of each individual on each of the 17 variables listed above. Children and adults were rated on the same scales and within the same frame of reference. Each investigator studied the case independently, and arrived at a set of ratings. Then a case conference was held and differences in assessment discussed. From this conference emerged a jointly agreed-upon set of ratings which were considered the final ratings on the case. It is these pooled ratings which then became the data upon which the subequent procedures were based. Twelve cases were re-rated by the pooled-ratings technique. The median *r* between first and second rating was .80.

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[5] The data from these families were collected by Mrs. F. Loria and Miss F. Hamlish.

Analysis of data at this point in the research was directed toward an examination of a hypothesis of intra-family transmission of psychological characteristics. The general statement of this hypothesis is as follows: the influence of the personality of the parents is sufficiently powerful to create significantly greater personality resemblances between individuals within a family than exists between members of different families. The results reported here are based upon statistical analysis of ratings on the aggression variables previously listed. This approach is obviously a crude one, subject to the deficiencies associated with attempts to quantify and condense material which is essentially qualitative. Despite the many methodological problems involved in the use of rating scales, they represent one of the few techniques available at present for describing group differences in behavior elicited by projective devices.

The general approach selected for examination of results entailed comparisons between pairs of individuals with respect to the total configuration of aggression ratings rather than comparison between pairs or groups of individuals on the 17 variables taken one at a time. The recent literature on profile analysis suggested the adoption of a coefficient of profile similarity as a suitable technique for assessing inter-person comparability of the aggressive aspects of personality with which the project was concerned (2). Of the several coefficients of profile similarity in current use, *r* appeared to be statistically appropriate for the psychological comparisons desired.[6] The choice of *r* followed experimentation with other techniques for assessing similarity between profiles. It was recognized that *r* equates individuals for level and scatter of the profile of rating scores and is disproportionately affected by profile shape. For our purposes and our data, however, the examination of trial cases indicated that this characteristic of *r* was more frequently than not in line with the psychological comparisons we wished to make.

In order to see more clearly the extent to which the results were dependent upon the use of the particular statistic chosen, an alternate method of assessment was adopted for comparison. An independent analysis was made using Cronbach's *D* (2). The results of these two approaches were quite comparable. Eight cases were randomly selected from the sample, and their *r* and *D* coefficients—with all other members of the sample—were compared. Each case thus treated provided 45 coefficients by each of the two similarity assessment techniques. A rank order correlation coefficient between *r* and *D* was computed for each case. The median correlation coefficient obtained was .86 for a distribution of coefficients ranging from .63 to .96. As expected, the large variations in rank order between coefficients offered by the two techniques tended to be accounted for by relatively few cases. Three of the eight cases provided 80 per cent of the rank order differences greater than 13.

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[6] This coefficient is obtained by the formula for Pearson produce-moment correlation. When used to compare personality profiles of two or more individuals, however, *r* is not a correlation coefficient and cannot be interpreted as such.

The interpretation of *r*, for the data of this research, is largely based on the relative rather than the absolute magnitude of the coefficient. Although the median *r* of the total distribution of 1,035 coefficients for our sample was .375, it would be psychologically meaningless to argue that this coefficient is or is not significantly greater than zero. The concept of zero similarity between the aggressive behavior of two persons would be a psychological notion difficult to defend. The fact that ratings can be made on the aggressive behavior of a pair of individuals assumes a degree of psychological similarity. However, the relative magnitude of *r* coefficients does afford a basis for comparing the similarity of profile of aggressive expression and permits an interpretation of the psychological significance of results thus obtained.

E. FINDINGS

The first step in the analysis required that the coefficient of similarity be computed for all possible pairings of the 46 persons in the sample. Inter-group comparisons were effected by drawing up distributions of the *r* coefficients between each pair of individuals within the designated sub-groups of the sample. The median was used as the measure of central tendency in assessing the relative level of similarity within one group as compared with another.

The basic hypothesis of the research was tested by examining three sets of data: (*a*) The general level of similarity between all pairs of related persons compared with similarity between all pairs of non-related persons.[7] (*b*) The level of similarity between parents and their children compared with similarity between non-related adult-children pairs. (*c*) The level of similarity among siblings compared with that between pairs of non-related children.

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[7] In line with the transmission hypothesis under study, husband-wife pairs were judged to be unrelated and were not included in the distribution of related pairs.

1. The most general statement of the hypothesis was not strongly supported. The median coefficient between all pairs of related persons was .425. Although an *r* of this magnitude indicates substantial intra-family resemblance, its interpretive significance is altered by the size of the median coefficient between all pairs of non-related persons (.370). The similarity in patterns of aggressive expression among unrelated persons in the sample was an anticipated result of the culturally shared attitudes toward aggression in American society. However, since persons in the sample exhibited a wide range of individual variation in aggressive behavior, it was expected that individual differences would tend to be transmitted from parent to child in a manner leading to much greater intra-family homogeneity than that effected throughout the sample by the more prevailing demands imposed by the culture.[8] The number of related pairs showing relatively little similarity of rating profiles was also high: almost 25 per cent of the related pairs produced coefficients of .100 or lower. Corresponding figures for the group of non-related persons are practically identical.

2. If the data are grouped to permit comparisons between parent-child pairs and non-related adult-children pairs, the hypothesis appears more acceptable. The median *r* for all parent-child pairs was .440; that for all non-related adult-child pairs was .354. Further analysis of this broad comparison (note Table 1) reveals the following trends:

a. The resemblance between fathers and their sons was relatively great (.475). However, this appears to be an expression of a general tendency of boys to resemble male adults in the sample, whether related to them or not. The coefficient between pairs of non-related male adults and male children was .422.

b. The similarity in pattern between sons in the sample and their mothers was relatively high (.425), although of somewhat less magnitude than the father-son resemblance. However, the boys showed considerably less resemblance to adult women to whom they were not related (.333).

c. The resemblance between daughters and their parents presents a different pattern than that shown by the sons. Girls in the sample hold relatively little resemblance to their fathers (.266). This is one of the lowest median coefficients of the groups examined. The median coefficient between fathers and their daughters assumes added significance when compared with the median coefficient for pairs of non-related adult males with female children (.327).

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[8] The range of coefficients for the non-related group was —.650 to .950. The range for the related group was —.350 to .850.

TABLE 1
MEDIAN COEFFICIENTS OF PROFILE SIMILARITY (r) FOR RELATED AND NON-RELATED GROUPS

	Number	r	Range*
I. Median Coefficients of Adult-Child Pairs			
Parent-Child pairs	52	.440	—.350 to .750
N.R. Adult-Child pairs	468	.354	—.650 to .950
Father-Son pairs	18	.475	—.250 to .750
N.R. Male-Adult Male-Child pairs	162	.422	—.550 to .950
Father-Daughter pairs	8	.266	—.050 to .750
N.R. Male-Adult Female-Child pairs	72	.327	—.550 to .950
Father-Child pairs	26	.450	—.250 to .750
N.R. Male-Adult All-Child pairs	234	.384	—.550 to .950
Mother-Son pairs	18	.425	—.250 to .750
N.R. Female-Adult Male-Child pairs	162	.333	—.650 to .850
Mother-Daughter pairs	8	.450	—.350 to .750
N.R. Female-Adult Female-Child pairs	72	.293	—.350 to .850
Mother-Child pairs	26	.430	—.350 to .750
N.R. Female-Adult All-Child pairs	234	.315	—.550 to .850
II. Median Coefficients of Child-Child Pairs			
Sibling pairs	22	.300	—.250 to .850
N.R. Child pairs	134	.333	—.650 to .850
Male-Child pairs N.R.	143	.337	—.450 to .850
N.R. Female-Child pairs	26	.300	—.250 to .850
N.R. Male-Child Female-Child pairs	134	.333	—.650 to .850
III. Median of Major Age, Sex, and Status Group			
All pairs	1,035	.375	—.650 to .950
All Related pairs	74	.425	—.350 to .850
All Non-Related pairs	961	.370	—.650 to .950
All Male pairs	378	.409	—.550 to .950
All Female pairs	154	.346	—.450 to .850
All Adult pairs	190	.440	—.550 to .850
All Child pairs	325	.334	—.650 to .850
All Male-Adult pairs	45	.517	—.550 to .850
All Female-Adult pairs	45	.425	—.450 to .750
All Male-Adult Female-Adult pairs	100	.420	—.550 to .850

*Based on mid-points of the highest and lowest intervals of the distribution.

d. The level of similarity between daughters and mothers was in sharp contrast to that between daughters and fathers. The median r for mother-daughter pairs was .450. However, in contrast to the male pattern, this similarity does not indicate a general communality of aggressive behavior among females. The median coefficient of .293 between pairs of non-related adult females and girls was near the low end of the range of median coefficients.

3. The third approach to the transmission hypothesis was a comparison of the degree of similarity between pairs of siblings with that of pairs of non-related children. The median *r* for sibling pairs was .300; the corresponding statistic for pairs of non-related children was .333. Although these figures offer no support for the hypothesis under study, their significance is modified by the presence of a high proportion of male pairs in the sample of siblings and the tendency toward low degree of resemblance between pairs of male siblings. It should also be mentioned that a comparison of median *D* coefficients indicated a substantially greater similarity among sibling pairs than among non-related children.[9] Until a larger sample of sibling pairs is available for statistical analysis, however, the disagreement on this comparison suggests that sibling resemblance was not sufficiently obvious to afford evidence in support of the transmission hypothesis.

In examining the data for patterns that might provide additional explanation of the initial results, it was discovered that intra-family homogeneity holds very little apparent relationship to the degree of similarity between the parents (Table 2). In two families, *B* and *C*, the parents were rated as highly similar. The median parent-child coefficient for Family *B* was .650, while three of the six corresponding coefficients for Family *C* fell below .250. Family I illustrates a complementary situation in which a low degree of similarity between parents does not necessarily lead to a lack of intra-family homogeneity. This family also shows the extent to which one of the parental pair may produce homogeneity among the children even though the other parent expresses a quite different pattern of aggressive behavior.

F. CONCLUSIONS

These findings suggest that on the variable under study, the influence of the personality of the parents does not generally lead to a high degree of homogeneity in their children and that factors appear to be operating to create variability among siblings comparable to that existing in non-related children. This generalization holds in families where the parents themselves were highly similar as well as in those in which parents were strikingly different.

The patterns of aggressive behavior transmitted from parent to child appear to be cultural patterns rather than the particular features of the individual parent. This applies especially to boys. Males tend to learn these cultural sex-typed patterns of aggression to a greater extent, or at least at an earlier age, than do females.

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[9] The results of analysis of *r* coefficients up to this point were corroborated in each comparison by data obtained from *D* coefficients.

TABLE 2

AGGRESSION RATING PROFILE SIMILARITY (r) BETWEEN PARENTS AND CHILDREN

Family	Parent with:	Mother	1st child	2nd child	3rd child
A	Father	.314	.212	.602	.687
	Mother	—	.350	.465	.051
B	Father	.764	.744*	.276*	.624
	Mother	—	.652	.602	.728
C	Father	.786	.031*	.413	.230*
	Mother	—	.100	.421	.491
D	Father	—.190	—.093	.673	.281*
	Mother	—	.379	—.243	—.317
E	Father	.309	—.076*	.595*	.765
	Mother	—	.044	.516	.436
F	Father	.157	.471	—.048	.475
	Mother	—	.178	.628	.311
G	Father	.414	.452	.565	
	Mother	—	.581	.400	
H	Father	.585	.631	.625	
	Mother	—	.394	.449	
I	Father	.040	.423*	.160	
	Mother	—	.708	.796	
J	Father	.514	.056	—.251	
	Mother	—	.557	.331	

*Indicates which of the children are girls.

The father and mother are strikingly different in the way in which they appear to influence aggressive behavior in their children. Our coefficients indicate that the similarity between fathers and their sons is relatively high, and that between fathers and daughters relatively low. However, the resemblance between fathers and sons *may* be largely accounted for by a general similarity among males. The highest median coefficient for any of the sub-groups, including related groups, was that of the male adults (.517). The coefficient between male adults and boys to whom they are not related was .422, which suggests that boys resemble their fathers in aggressive behavior less because they are members of the same family than because both are males.

The mother appears to transmit to her children more of her individual features of aggressive behavior than does the father. In contrast to the pattern displayed by males, girls resembled their mothers much more than other adults, either males or females. The coefficient between unrelated pairs of girls and female adults was .293. A comparison of this coefficient to that obtained between mothers and their daughters (.450) indicates the extent to which mothers transmit their individual aggressive behavior to their daughters. A comparable relationship appears between mothers and their sons, since the boys in the sample resemble their mothers but do not appreciably resemble other female adults. It is apparently the mother, rather than the father, who transmits individual variations on the cultural theme of control and expression of aggression. While this finding of the apparently individuating influence of the mother is in keeping with much current thinking on her crucial rôle in personality formation, the absence, in the present study, of a comparable significance for the father gives rise to a more important question than it answers. There is no reason to assume, either *a priori* or on the basis of current knowledge, that personalities are *generally* more similar among males than among females. Yet in aggression, as that component of personality has been investigated here, they do show greater similarity, so that boys show no significantly greater similarity to their fathers than they do to other men. The question of whether a father's aggression pattern has some individuating effect on those of his children would seem to merit further investigation.

It should be emphasized that the present paper is confined to similarity in overall patterns. The findings thus obtained may obscure similarities on particular aggression variables. It also bears repeating in the present context that children's aggression patterns may be systematically related to other aspects of parental personality than aggression. This issue, beyond the scope of the present study, is one that will also have to be investigated if we are to gain a fuller understanding of personality formation.

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The Journal of Genetic Psychology, 1956, **89**, 213-220.

ELECTROCONVULSIVE SHOCK AND THE LEARNING OF VISUAL PATTERNS*

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A. Literature and Problem

In recent years there has been extensive study on the effects of electroconvulsive shocks on learning and retention of habits. Although most of this experimental literature indicates a decrement in performance, some does not. Stainbrook and Lowenbach (14) found that ". . . the maze performance of rats, insofar as error scores are concerned, does not appear to be affected by a long series of convulsions evoked either by electric shock or by noise-fright stimulation" (p. 298). Siegal (13) reports that the ability of a rat to learn a simple habit is not adversely affected by a series of electroconvulsive shocks. Russell (12) also indicates that electroconvulsive shocks do not tend to impair simple habits. In an experiment in which albino rats were trained on a 14-unit maze and then subjected to 23 days of daily electroconvulsive shocks, McGinnies (9) found that the animals showed no increase in error during the 23-day period, but did exhibit a pronounced average increase in running time.

On the other hand, Duncan (5), using 28 male white rats trained on the Lashley III maze, reports that electroconvulsive shock has a markedly detrimental effect on a recently learned difficult habit. McGinnies and Schlosberg (10) observed that ". . . a very difficult habit, such as double-alternation lever-pressing, will break down completely following only two convulsive incidents" (p. 373). Braun, Russell, and Patton (1) report decrements in both the learning and retention by the albino rat of a 5-choice-point (modified Lashley III) water maze immediately after the completion of a series of 25 controlled electroshock convulsions.

In a preliminary study on the effect of electroconvulsive shock on spatial learning, Fosmire and Brown (6) found that subsequent daily postrun shock of the animals after they had mastered the maze to a criterion of four errorless runs produced an increase in errors. A second study by Brown and

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*Received in the Editorial Office on April 20, 1955.

[1] The cost of this investigation was met in part by a grant to the senior author by the Research Institute of The University of Texas.

Fosmire (3) confirmed their belief that electroconvulsive shock was responsible for the inferior performance of the shock animals.

A study by Brown and Wilbanks (4), while using the spatial problem studied by Fosmire and Brown, attempted to isolate the number of shocks beyond which no further impairment in learning is apparent. They found that the animals which were shocked daily for 18 days never performed better than slightly under chance. They suggest that electroshock convulsions may prevent the formation of a stable memory trace and concluded that ". . . electroshock convulsion evidently reduced spatial learning to response learning."

The question as to what is the actual cause of the behavioral impairment produced by electroconvulsive shock has been taken up in several studies. Hayes (7) reports that the current *per se* is not productive of brain damage. He states that ". . . a consideration of the pertinent electrical principles reveals no basis of expecting moderately large currents to be harmful" (p. 59). But Duncan (5) concludes that ". . . the loss of the habit and probably also the curing of mental patients are due, not to the punishment or fear of electroshock, but to a direct effect on cerebral tissue" (p. 278). Porter and Stone (11) believe that electroshock convulsions produce brain damage, and that this is what underlies the decrement in learning and retention. They suggest that ". . . when etherization eliminates the convulsion, the electric shock has but a mild effect which will not impair performance in measurable degree" (p. 454). Braun, Russell, and Patton (2) assume that ". . . a series of controlled electroshock convulsions is followed by a permanent impairment in the retention of a habit of the complexity of the Lashley III maze" (p. 337).

Horowitz and Stone (8), on the other hand, have suggested that ". . . given sufficient time, full recovery from the deleterious effects of 15 convulsive shocks, as measured by the light discrimination method, will take place in the albino rat" (p. 21). They also point out that ". . . electroconvulsive shocks produce in rats a measurable disorganization in performance of light discrimination habits" (p. 21).

In a preliminary study by Fosmire and Brown (6) on the effect of *ECS* on spatial learning they made two observations:

> 1. The shock animals were fairly blind when recovering from shock. When they were returned to the home cage, they did not begin eating immediately as did the controls, but would walk around the cage, through the food, stopping to eat only when they chanced to step in the food. It was also observed that the noise from the electroshock apparatus, if it frightened a recovering rat, the rat would sometimes, if not caught

> in time, run off the table. Once on the floor the animals would run into the wall, seemingly not perceiving its presence.
>
> 2. There was considerable dilation of the pupil of the rat's eyes when convulsively shocked. Before shock, the pupil of the eye would be about the size of a pin head; immediately after shock, many times that size. This extreme dilation was noticed an hour after recovery from shock. It may be that some significant differences in behavior are attributable to changes in the eye and in visual perception (p. 73).

The present experiment was designed to investigate the learning of visual patterns by the albino rat during daily electroconvulsive shocks. The results obtained by Horowitz and Stone (8) on light discrimination habits and the observations made by Fosmire and Brown (6) suggest that visual impairment may result from *ESC*.

B. MATERIALS AND METHODS

1. *Apparatus*

A modification of Lashley's discrimination apparatus was used to study visual discrimination in the present experiment. A light of 25 watts was used to illuminate the stimulus cards during the training period.

The study was conducted between 9 A.M. and 11:30 A.M. daily for 38 days.

2. *Animals*

Forty-six experimentally naïve albino rats were used in the studies. All were of Wistar Strain and were reared in the Comparative Psychology Laboratory of The University of Texas. They were approximately 90 to 120 days old at the beginning of the experiments. The diet consisted of five parts (by weight) of yellow cornmeal, one part of linseed meal, one part of ground alfalfa, and one part of powdered buttermilk. About 50 grams of salt and 50 grams of calcium carbonate were added to each five pounds of cornmeal. Codliver oil was added to the mixture twice a week. The mixture was moistened with water.

3. *Scoring*

If an animal jumped to a negative stimulus card, an error was recorded. If an animal did not jump after one minute on the stand, a tetanizing shock of 50 volts was applied to the grid of the jumping apparatus, thereby forcing the animal to jump. The animal was not shocked unless it was facing one of the discrimination cards.

4. *Shock Supply*

The shock supply used was a duplication of the one described by Hayes (7). It consisted of a step-up transformer, an automatic timing device, and a current selector resistance unit. The shock supply was connected to a 110-volt *AC* supply which was fed directly to the transformer primary winding upon closing the control switch. With primary current flowing, the secondary voltage was 1,500 volts. A delayed-action relay, which cut off the shocking current 0.2 seconds after its coil had been energized by pressing the shock button, controlled the duration of the shock.

C. Experiment 1

1. *Procedure*

The 22 animals used in Experiment 1 were given seven days of preliminary training preceding discrimination training. This consisted in placing the subjects on the grid of the apparatus and allowing them to walk through the stimulus card openings into the food box. The distance was gradually lengthened between the grid and the openings until the animals were able to jump nine inches. The animals were forced to use both apertures in order to prevent the development of position habits during preliminary training. This was accomplished by placing a piece of glass over one of the apertures. When the animals jumped freely from the required distance, two cards with *alternating black and white lines ¾ inch wide. were placed in the apertures with the lines horizontal.* The cards were the same in size and position as the positive card during discrimination training. This phase of preliminary training lasted for two days, with 10 jumps a day. When discrimination training began, the animals were presented with a card with ¾ inch black and white horizontal lines (the positive stimulus) and a card with ¾ inch black and white vertical lines (the negative stimulus). The stimulus cards were alternated in position according to a set pattern in which each card was on the right half of the time and on the left half of the time. The positive stimulus card (horizontal lines) alternated between the right and left position on the first trial each day.

The subjects were fed wet mash in a small jar secured to the back of the food box. They were allowed to eat about 15 seconds after each correct discrimination. The remainder of the daily ration was given in the home cage.

Two groups of animals were used in Experiment 1. The Control Group ($N = 11$) was given 10 jumps daily for the duration of the experiment (12 days). These animals were not subjected to electroconvulsive shock. The Experimental Group ($N = 11$) was given the same number of jumps as the animals in the Control Group and was subjected to one daily electroconvulsive shock of 50 ma. *AC* for 0.2 seconds for the duration of the experiment. This was administered, approximately 15 minutes after the completion of the jumps, through padded alligator clips, saturated in a saline solution, and attached to the rat's ears as close to the skull as possible.

2. *Results*

The results for the present study are presented graphically in Figure 1. An examination of the figure will show the following: (*a*) The learning curves for the two groups are practically the same. (*b*) It took seven days for the animals in the Control Group to reach a perfect score. (*c*) Although the animals in the Experimental Group never reached the proficiency exhibited by the controls they did nevertheless make a perfect score on the tenth day.

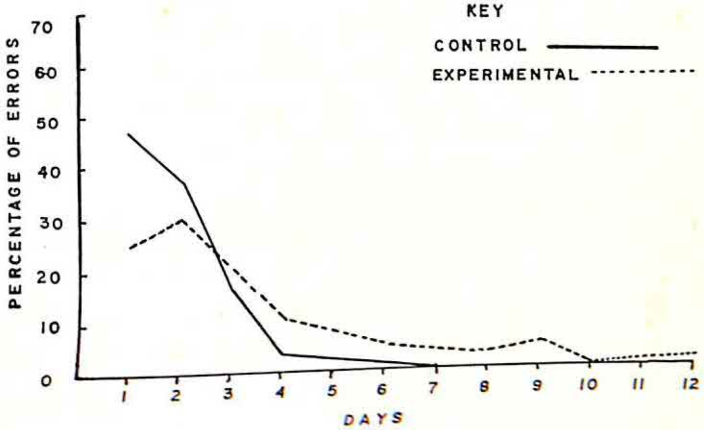

FIGURE 1
ERROR SCORE CURVES FOR EXPERIMENT 1

A *t* of .458 was obtained between the groups. This would seem to indicate that the deviation between the groups is attributable to chance rather than to any effect the convulsive shocks might have produced on the animals.

Beginning on the third day of training the experimentals exhibited a much longer latency before jumping than did the controls. They were also more nervous and excitable after several shocks than were the controls.

3. *Discussion of Results*

In general, the results of this experiment indicate that electroconvulsive shocks administered to white rats do not affect their learning of visual patterns of the difficulty provided in this experiment. The electroshock convulsions produced no real decrement in the learning of the visual patterns presented in terms of error scores. The main difference between the groups was in delay. The experimentals were much slower in jumping after the first three days than were the controls. Furthermore, they were more nervous and excitable.

Our failure to get a decrement in learning may be due to the problem presented. It is entirely possible that the ¾ inch horizontal and vertical lines did not present a problem sufficiently critical to produce a decrement in the performance of the shock animals. Russell (12) states that "the effects of electroshock convulsions on learning and retention are, in part at least, functions of the difficulty of the task or habit involved" (p. 142).

It is assumed that since no real decrement in error was produced, electroconvulsive shock does not affect the learning of visual patterns of the difficulty provided in this experiment.

D. Experiment 2

A second experiment was designed to present the animals with a more difficult problem than that provided in Experiment 1.

1. *Procedure*

The general procedure in Experiment 2 was the same as that employed in Experiment 1. Experimentally naïve animals were trained for the Control Group (12 animals) and the Experimental Group (12 animals). The stimulus cards used in the second experiment were the same in design as those used in the first, but the black and white lines were ¼ inch rather than ¾ inch.

2. *Results*

The results of Experiment 2, which are presented in Figure 2, will show that the error score curves for the controls and experimentals are similar. They begin at about the same level and then separate and decline at about the same rate. Although the experimentals made but one perfect score, they nevertheless exhibited few errors after the eighth day.

A t of 1.576 was obtained between the mean errors for the groups. This result seems to indicate that the deviation between the groups was probably due to chance.

3. *Discussion of Results*

In general, the results of Experiment 2 are similar to those of Experiment 1. The administering of electroconvulsive shock to white rats does not seem to impair significantly their ability to learn visual patterns of the difficulty provided in these experiments. However, the differences between the controls and experimentals are greater in this experiment than in Experiment 1. The *t* in Experiment 1 is .458 and in this experiment 1.576. Even though the *t* between the controls and experimentals is not significant at the 5 per cent level in Experiment 2, its difference from the *t* in Experiment 1 would seem to indicate that the second problem is more diagnostic of decrement in the learning of visual patterns during electroconvulsive shock than the first problem.

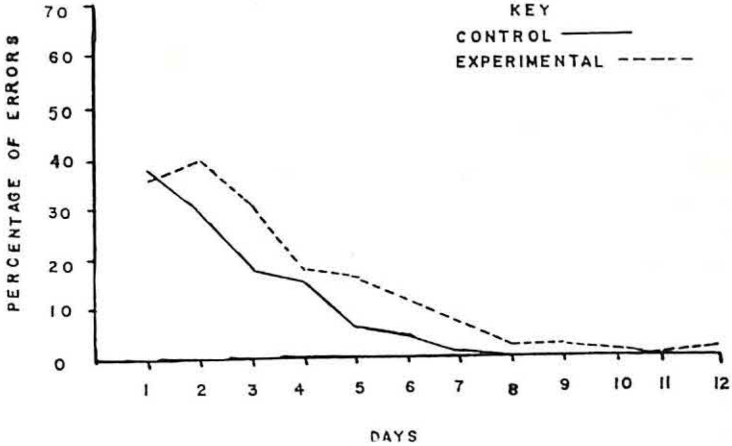

FIGURE 2
ERROR SCORE CURVES FOR EXPERIMENT 2

E. SUMMARY AND CONCLUSIONS

1. In Experiment 1 two groups of animals were trained on a visual discrimination problem using ¾ inch black and white vertical and horizontal lines. The Experimental Group received one electroconvulsive shock after each training period. Since no difference in error was observed between the groups, it is assumed that *ECS* does not affect learning of visual patterns of the difficulty presented in this problem.

2. Experiment 2 was designed following the attainment of negative results in Experiment 1. The experimentals were given one *ECS* daily during the experiment. The error score difference was greater between the controls and experimentals in Experiment 2 than in Experiment 1.

3. The experimentals in both experiments spent much more time on the jumping stand before making discriminations than did the controls.

4. Even though the differences in error between the controls and experi-

mentals in Experiment 2 are not significant at the 5 per cent level of confidence, the increased magnitude of the difference over that found in Experiment 1 suggests that some decrement was present. Additional experimental work is needed to determine conclusively the effect of *ECS* on visual discrimination. If more difficult visual discrimination problems were presented to *ECS* subjects, they might solve them by the adoption of position habits. This would be in agreement with the findings of Brown and Wilbanks (4) that *ECS* may reduce the performance of animals on difficult learning problems to position habits.

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The Journal of Genetic Psychology, 1956, **89**, 221-230.

THE STRUCTURAL ASPECTS OF SCHIZOPHRENIC RESPONSES TO AUDITORY STIMULI*

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A. INTRODUCTION

Previous studies (1, 2, 3, 4) have demonstrated the utility of comprehending the productions of neuropsychiatric patients, as well as normal subjects, within the framework of a general developmental law. In these studies, the structural aspects of visual perceptual functioning were related to Werner's (5) conception of all organic development having steadily increasing differentiation and hierarchic integration as its essence. The findings indicated that differentiation and hierarchization increased with ascendancy of the genetic scale in normal subjects, and decreased with severity of psychopathology in adult neuropsychiatric patients.

As suggested by Wyatt (6), these investigations may be viewed as reflecting the vicissitudes of one limited aspect of a broader mental activity, ego functioning. The question may be raised as to whether such studies, dealing with visual perceptual structurization, aid in bringing the structural nature of ego functioning as a whole into consonance with this general developmental law described by Werner. Ultimately, then, one might be tempted to use the findings of such studies as supporting the argument for an holistic concept of ego functioning. This would then point in the direction of investigating other aspects of ego functioning, for the ego in its fundamental activity of mediating between organism and environment employs many channels, sensory and motoric.

It was with this in mind that the present study was undertaken. The purpose was to investigate whether responses to stimuli presented through another sense modality, audition, could be comprehended within the framework of the general developmental law which proved applicable to the responses produced to visual perceptual stimuli. The functioning of the psychotic adult subjects with regard to the structural aspects of visual perception suggested a comparable specific hypothesis for the present study: schizophrenic patients will exhibit less differentiation and hierarchic integration

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*Received in the Editorial Office on June 21, 1955.

than normal adults in the structural aspects of their responses to auditory stimuli.

B. PROCEDURE

1. *Stimuli*

The auditory stimuli consisted of the following 20 patterns[1] of three sound effects each, recorded on a magnetic recording tape:

1. Telephone dialing, telephone busy signal, hanging up telephone receiver.
2. Woman walking, chair creaking, typewriting.
3. Horse whinny, dog barking, steamboat whistle.
4. Police squad car siren, squeal of auto brakes, machine gun firing.
5. Oil well pumping, burglar alarm bell, water gurgling out of bottle.
6. Wind, auto horn, crash of glass.
7. Baby crying, woman running, woman screaming.
8. Thunder, door shutting, rain.
9. Pigeon cooing, ship's danger whistle, hammering a nail into wood.
10. School dismissal bell, anaesthesia machine or pulmotor, footsteps running downstairs.
11. Cash register, goat, telegraph key.
12. Door closing, stream of water, toilet flushing.
13. Calf, wind, squeaky door closing.
14. Alarm clock bell, insistent rapping on door, metronome or clock ticking.
15. Pig squealing, school bell, escaping gas.
16. Rooster crowing, pneumatic hammer on steel plate, door bell.
17. Air raid alarm siren, airplane power dive, auto starting.
18. Clucking hen, breaking of drinking glass, cow.
19. Ordinary rapping on door, clanging bell, lion roar.
20. Fusillade of shots, telephone ringing, railroad train running.

The subject was seated approximately three feet in front of a tape recorder and given the following instructions: "You are going to hear some sounds, one after another. These sounds will tell a story, or part of a story, about something happening. When I finish playing them, I would like you to tell me what story, or part of a story, the sounds make you think of." The goal of these instructions was to indicate with minimal structuring to the subject that something beyond enumeration, identification, or description was possible, and at the same time to avoid the implication that the number of sound effects used in a response was of any significance to the examiner.

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[1] These were selected from an original total of 29 patterns in order to keep testing sessions under an hour. In a preliminary study 15 normal adult subjects were tested on the original 29 patterns, and the nine poorest patterns were eliminated on the bases of potential discriminatory ability and clarity of response.

The first pattern of three sound effects was then played and the recorder stopped. If the subject produced an interpretive response combining two or three sound effects, the next pattern was immediately presented. If not, he was encouraged, no matter what other response was given, by the question: "What story, or part of a story, do the sounds make you think of?" No urging beyond this additional question was employed for any particular pattern. This encouragement was discontinued after the fifth pattern, regardless of response. A single constant setting of the recorder volume control at a level well above the normal auditory limen was used throughout the entire study. Generally, once a response was obtained, no further questioning was used. However, in those cases in which it was not clear as to how many, or which, sound effects of a pattern were being used in the response, a non-leading question was put to the subject, e.g., "What was there in what you heard that made it sound like . . .?"

In the construction of the patterns of stimuli, the sound effects were chosen randomly for 13 of the patterns. However, the sequences of sound effects in Patterns 1, 2, 4, 7, 8, 12, and 17 were deliberately arranged in the hope that it would be relatively easier to combine interpretively all of the sound effects of any of these patterns. Thus, having placed these patterns in their present order it was felt that (*a*) Patterns 1 and 2 might act as "ice-breakers," and (*b*) Patterns 4, 7, 8, 12, and 17 would encourage the subject after he had been faced with what might be the more stressful, relatively more difficult, patterns.

To understand the responses of the two groups within the theoretical framework proposed, it was felt that criteria had to be set up which could allow evaluation along at least the major dimensions of such a framework.

2. *Method of Scoring*

a. Responses revealing differentiation and hierarchic integration (DHI responses). For an interpretive response in which the three sound effects presented are differentiated and stand in clear relation to one another and to the single unifying theme of the response which integrates them, a score of 1.0.

Ex: Pattern 1. "Somebody dialed a phone, got a busy signal, and hung up the receiver."

Pattern 5. "In a shop, the first sound is machines, punch press—bell rings signalling lunch or break time and they're pouring coffee out of a thermos bottle."

Pattern 9. "First sound a hoot owl or turtle dove—then with the sound of a boat whistle, then the sound of hammering—could be they're crating up birds for shipping on a boat."

Pattern 15. "Pigs snorting away because it must've been the farmer's device to sound feeding time with the bell and the last sound was dumping the feed into the trough."

For an interpretive response in which two of the three sound effects presented are differentiated and stand in clear relation to each other and to the single unifying theme of the response which integrates them, a score of 0.5. In such cases, the remaining sound effect may be (*a*) omitted; (*b*) merely responded to without relationship to the other sound effects or to the theme of the main response; or (*c*) an additive elaboration bearing no necessary or essential relation to the other sound effects or to the unifying theme.

Ex: Pattern 3. "A horse whinnying, a dog barking, and a boat whistle—loading a horse on the boat and the dog barking."

Pattern 10. "Seems the alarm clock went off and the individual it was set for went right on snoring away—and someone else running downstairs, perhaps children."

Pattern 12. "First off, sounded like somebody closed the bathroom door and started running water into a tub for a bath—last one, couldn't make nothing out of it."

Pattern 13 "Somebody going into a cabin out of the wind—and an animal yelling or a man."

The numerical values were arbitrarily assigned and no assumptions were made as to the equality of scale intervals. The only justification for giving one response a greater numerical value than the other stemmed from the assumption that the use of three, rather than two, sound effects in a response, in the manner established by the criteria, may reflect a greater degree of differentiation and hierarchization, and consequently a genetically higher level of integrative activity. Such an assumption, although desirable, is not crucial for testing the hypothesis of the study. The more important consideration was establishing reasonable criteria to permit distinguishing between those responses which revealed differentiation and hierarchic integration from those which did not.

Further, it seemed desirable to obtain a more direct measure of the primitivized functioning entering into the structuring of a response. This functioning was most clearly reflected in those responses which could be conceived of as revealing a diffuse homogeneity of organization.[2]

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[2] In discussing this type of primitive activity, Werner (5) describes the indi-

b. Responses revealing diffuse homogeneity of organization (DHO responses). Where the three sound effects are embodied in a diffuse undifferentiated global response, a score of 1.0. In such cases the sound effects are responded to on the basis of meaning derived from the totality, revealing no other clear relationship to one another, and any one of them could be omitted without altering the response. (It is quite possible that many such responses may be arrived at via a type of "pars pro toto" functioning from a single sound effect. However, no clear advantage was seen in establishing another scoring type for this.)

Ex: Pattern 14. "Three ways of waking up—one is a time clock and the other is an alarm for a clock and the other is a pendulum."

Pattern 17. "All aeroplanes—three of them."

Pattern 19. "Second one a bell, first one knocking on a door, third one like a foreign animal to me—oh, first could have been a gavel calling a meeting together, bell calling school children together, and third one a wild animal calling its group together."

Pattern 20. "This is all in a factory: knocking, someone wants to go in an office; telephone ringing; machinery."

Where two, rather than three, sound effects are used as described above in the 1.0 DHO response, a score of 0.5. (A lower value was used with responses embodying two sound effects as it was felt that the omission of one of the three, or treating one sound effect differently than the other two, was suggestive of some differentiating activity and awareness of lack of total homogeneity.)

Ex: Pattern 4. "First part a siren, last part a machine gun—police cars pulling into some spot and firing at fugitives—first a siren, and second a siren, then machine gun."[3]

Pattern 8. "A description of power, the two different things—and like a gangster running away."

Pattern 11. "A goat making a racket—and another noise sounded like a goat pulling something, cart, or something."

Pattern 18. "Around a farm someplace—hear chickens and cows."

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vidual's productions as characterized primarily by "qualities-of-the-whole," i.e., constituent parts are not articulated and do not stand in clear relation to one another. The structure of the production is diffuse, and each part contains some of the quality-of-the-whole. Further, in making the constituent parts more uniform and alike, a "homogeneization" typical of diffuse organization is reflected.

[3] Such a response indicates that both diffuse homogeneity and genetically high activity may be embodied, and thus both scored, in a single response: thus, calling the first two sound effects "sirens" reveals the former quality, the differentiation of a siren and a machine gun and integration of the two into an action theme, revealing the latter.

The same theoretical considerations and assumptions held for the criteria and scores of the latter dimension as for the dimension of differentiation and hierarchic integration. However, with the *DHO* responses, the use of three, rather than two, sound effects was considered to reflect a genetically *lower* order of activity, i.e., a greater degree of diffuse homogeneous organization.

The subjects were 24 normals and 20 schizophrenics, all white males. The normal group consisted of employees of four sections of a VA Hospital. None of this group had a history of treatment for, or complaints of, neuropsychiatric or psychosomatic ailments. The schizophrenics consisted of the following subtypes: 11 paranoid, 4 hebephrenic, 3 undifferentiated, 1 catatonic, and 1 simple.[4] The diagnoses were established by the psychiatric staff of the patient's hospital, and clinical records did not reveal any defects in auditory acuity. *IQ*'s were derived from one of three standard intelligence tests which were either already reported in the subject's records or administered by the author. Although from the most rigorous standpoint *IQ*'s from different tests are not comparable, limited testing time dictated this procedure for establishing equivalence of groups with regard to *IQ*. Table 1 summarizes the age, *IQ*, and schooling of both groups. None of the differences between the groups in these respects were significant.

TABLE 1
RANGES, MEANS, AND MEDIANS OF AGE, *IQ*, AND YEARS OF EDUCATION FOR BOTH GROUPS OF SUBJECTS

	Normal adults	Schizophrenics
No. of cases	24	20
Age:		
Range	21-41	22-41
Mean	30.8	31.0
Median	30.9	31.0
IQ:		
Range	86-124	85-129
Mean	100.5	100.6
Median	97.5	98.0
Years of education:		
Range	4-16	8-18
Median	11.9	11.5

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[4] The author wishes to express his appreciation to the staff of Marcy State Hospital, N. Y., who made it possible to obtain protocols from part of this group of patients.

C. Results and Discussion

Each protocol, bearing no identifying information about the subject who produced it, was scored for the following variables: number of 1.0 value *DHI* responses, number of 0.5 value *DHI* responses, total number of *DHI* responses, and a *DHI* Score which was the sum of the numerical values of all *DHI* responses. Similar data was obtained for the *DHO* responses. The differences between the groups on the *DHI* and *DHO* variables were tested by chi-square which was used in the manner described in a previous article (1) by the author. Table 2 presents these findings expressed in Probability (*P*) values, as well as the median values of all variables for both groups.

TABLE 2

Significance of Differences between Groups on All *DHI* and *DHO* Variables

Variables	Medians		*P*
	Normals	Schizophrenics	
No. of 1.0 *DHI*	8.5	1.5	<.001
No. of 0.5 *DHI*	4.3	2.8	.01-.001
Total *DHI* responses	13.8	3.5	<.001
DHI Score	11.3	2.6	<.001
No. of 1.0 *DHO*	.3	.8	>.10
No. of 0.5 *DHO*	1.0	2.0	.02-.01
Total *DHO* responses	1.5	3.1	.01-.001
DHO Score	1.0	2.0	.05-.02

From Table 2 it appears that the schizophrenics, as a group, produce significantly less *DHI* responses of any type, and have a significantly lower *DHI* Score, than the group of normal adults. No significant difference exists between the groups in number of 1.0 value *DHO* responses. However, the schizophrenic group is significantly greater in the number of 0.5 value *DHO* responses, total number of *DHO* responses, and in *DHO* Score.

If these findings are viewed within the conceptual framework used to establish the scoring criteria, schizophrenics reveal an impairment in differentiation and hierarchic integration. Further, their functioning could be considered as more primitive in terms of the dimension of diffuse homogeneity of organization.

It is interesting to note that the results tend to support the assumption that a response which integrated three, rather than two, sound effects may be of a higher order of functioning, and thus should be assigned a greater numerical value. This can be observed in the first two rows of Table 2, which suggests that it is relatively more difficult for schizophrenics to produce 1.0 than 0.5 *DHI* responses, whereas the converse obtains in the normals. This observation was examined further by applying chi-square test to the difference between the groups in number of cases having fewer 1.0 than 0.5 *DHI* responses. By such test, the schizophrenics show significantly less ($P < .01$) cases having more 1.0 than 0.5 *DHI* responses than do the normal adults. Thus, at least for future research, the indication would be to preserve the distinction between *DHI* responses which integrate three and two sound effects. The *DHI* Score could then be used as an overall single weighted measure of the type of functioning thought to reside in *DHI* responses.

No analogous relations exist for the numerical *DHO* scores, and it is doubtful whether the distinction between 1.0 value and 0.5 value responses is worth preserving. The two groups of subjects, although revealing significant differences, resemble each other more closely in the production of *DHO* responses than is the case for *DHI* responses (see Table 2). One explanation may be poor validity of the *DHO* scores (particularly with regard to the 1.0 score). However, another possibility may be considered which is consistent with the theoretical framework adopted for this study. Werner's (5) genetic concepts provide for the subordination of primitive levels of activity to higher forms as development proceeds, rather than for the complete disappearance of such levels. Primitive mental patterns are considered to be not only the background from which innovation of higher levels emerge, but also ever-present in the normal adult as well as the pathological, the former being distinguished from the latter by a shift in dominance to a higher level. Thus, it would not be inconsistent to find that appropriate indices of primitive activity are not so apt to differentiate the normal from the pathological as would measures of higher level functioning.

A question is raised by the method of administering the stimuli. The instructions and the encouraging remarks given during the first five sound effect patterns may actually tend to push the subject in the direction of integrating the sound effects. If this be so, it may be possible that the differences between the groups in production of *DHI* responses could be a function of the schizophrenic's inability to establish and maintain a set for integration beyond the first five patterns. One would expect, then, that the difference between the production of *DHI* responses to the last 15 patterns and the first five would be greater in the schizophrenics than in the normal adults, the former showing decreased *DHI* responsivity during the last 15 responses.

To investigate this, two *DHI* variables were used: total number of *DHI* responses and *DHI* Score. In calculating the differences between the first five and last 15 responses, in each case the total number of *DHI* responses and the *DHI* Scores for the last 15 patterns were divided by three to make the findings of the two sets of patterns comparable. The median difference for the schizophrenics in total number of *DHI* responses was —0.3, in *DHI* Score —0.17; for the normal adults —1.7 and —1.59 for each variable respectively. Although the median values of the differences are in the direction of a greater loss for the normal adults in *DHI* responses in the second set (last 15) of sound patterns, the two groups, by chi-square test, did not differ significantly ($P > .05$) for either *DHI* variable. Thus it seems unlikely that the differences between the groups in production of *DHI* responses can be ascribed to a differential effect of the ability to maintain a set for integration beyond situations in which such a set was encouraged. Rather, it seems that the schizophrenic group tends to maintain its relatively lower *DHI* responsivity in a constant fashion.

In overall perspective, the findings of this study lend themselves to understanding within the framework of a general developmental law, the essence of which, as Werner (5) points out, is increasing differentiation and hierarchization. As with the studies (1, 2, 3, 4) dealing with structural aspects of visual perception, this application of genetic theory to psychopathology may aid in further specifying the parallelism between general development and psychopathological phenomena. An obvious limitation in such specification lies in the relatively small and artifically isolated segments of the phenomena under study; in the present case, only the structural aspects of responses to auditory stimuli. Another limitation exists in oversimplifying and disregarding much of the complexity involved in producing the responses in order to quantify and comprehend them within a conceptual framework applicable to a wide variety of behavioral and mental phenomena. In effect, we are dealing with the complex activity of what has been most readily called, and perhaps most inadequately defined, the ego. Examining the varied end-products of this aspect of mental life within a single theoretical framework may bring us a little closer to a satisfactory definition of ego functioning, particularly when the concepts of such a framework permit of some relatively quantifiable predictions. Consideration of the present findings and those from the studies on the structural aspects of visual perceptual functioning (1, 2, 3, 4) suggest a holistic nature of ego functioning which can be understood in terms of the organismic genetic concepts of differentiation and hierarchic integration.

To gain more definitive specification of ego functioning, further research is needed to establish genetic parallels between other groups of psychopathological and normal subjects using the auditory sense modality, as well as similar investigations of other productions of ego functioning. Although such studies may be unable to investigate process directly, they begin to comprehend a wide variety of end-products of process as lawfully produced in a relatively predictable fashion.

D. Summary

The purpose of this study was the investigation of responses given by schizophrenics and normal adults to auditory stimuli, and their comprehension within a general developmental law. This approach has been found useful in studies dealing with the structural aspects of visual perceptual functioning. These studies may be considered to reflect only one limited aspect of ego functioning. They suggested, however, the present hypothesis: schizophrenic patients will exhibit less differentiation and hierarchic integration than normal adults in the structural aspects of their responses to auditory stimuli. Twenty patterns of three sound effects each were presented to 24 normal adults and 20 schizophrenics. A method of analyzing the structural aspects of the responses in terms of degree of differentiation and hierarchic integration, as well as degree of diffuse homogeneous organization, was devised. Considering the findings from this genetic standpoint, the schizophrenics revealed significantly less differentiation and hierarchic integration, and significantly more diffuse homogeneity of organization, than did the group of comparable normal adults. Thus, from the viewpoint adopted for this study, the functioning of schizophrenics shows a relative consistency of response to both auditory and visual stimuli which can be comprehended within a genetic conceptual schema.

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The Journal of Genetic Psychology, 1956, **89**, 231-238.

AGE AND SUITABILITY FOR NONDIRECTIVE PLAY THERAPY*

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A. INTRODUCTION

"In spite of several books and many articles, psychotherapeutic processes in work with children are still insufficiently elucidated" (23, p. vi). One of the areas of ignorance is that of the most suitable age for play therapy. Although recommendations and rules of thumb have been accumulating for more than 30 years, there is a scarcity of experimental investigations of the problem. A recent review of the literature of nondirective play therapy (11) did not indicate any work on this question.

When the writer was trained in play therapy he was taught that nondirective play therapy methods and equipment began to lose their effectiveness with children 12 years old. When the writer taught play therapy he and his students searched the literature for statements relative to ages suitable for play therapy. The first such statement seems to have been that of Hug-Hellmuth who, in 1921, suggested that, ". . . the analyst can pave the way by sharing the play activity . . ." of children seven or eight years of age (7, p. 294).

More recently Rogers has written that: "Between 4 and 10 or 12, some use of play techniques would almost certainly be advisable since verbalization of significant feelings is not easy for the child at this age" (17, p. 74). In general, this statement seems to epitomize the feelings of other play therapists no matter what their method. More recently Dorfman (3), also a nondirectivist, has suggested that children of "approximately eleven years and over" be allowed to examine and select either a playroom or an office for their therapy.

Psychoanalytically oriented therapists were the first to extend their methods to children (12). They have long recognized that the expressive medium of speech varies in significance from one age level to another (2). Conse-

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*Received in the Editorial Office on June 26, 1955.

[1] The writer wishes to thank Dr. Glenn Terrell, Jr., Florida State University, for his advice and encouragement. Thanks are also due to the writer's Indianapolis colleagues who discussed the paper at their bimonthly seminar. The suggestions of Drs. Arnold H. Buss and Marvin Zuckerman were especially helpful.

quently, for maximum effectiveness the method of approach to the child must change as his age changes. Rambert (16), like Rogers, locates the upper age limit for play therapy between the ages of 10 and 12. Alexander (1) sees a broader demarcation, i.e., 10 to 14 years. Sanger (18) says that play therapy is generally best for children below the age of 12. Wertham suggests an upper age of 10, "but children up to 12 can also be included" (22, p. 62).

Possibly statements such as these are responsible for Jones' summary that: "It is quite generally agreed that the greatest chance for successful therapy lies with the child under thirteen years of age" (8, p. 190).

However it is important to note that, despite the quite *general agreement*, no more than rules of thumb seem to exist in regard to age and suitability for play therapy. The only bit of experimental evidence seems to be that of Goller (4) who investigated children in Slavson's merger of group therapy with individual play therapy (21). While the groups range from 4 to 15 years of age (19), Goller found that, for complete success in such group therapy, the child must be under 13 years of age (4).

This single statistical investigation is the only one turned up by a search of the literature conducted by grade-conscious students and a new instructor. Its findings do not seem to be applicable to nondirective play therapy for several reasons: For one thing, the investigation concerned group therapy. The effect of the group on the child causes him to act differently than he would in individual play therapy. Secondly, the material, equipment and rôle of the therapist varied with each age group. The investigation was not concerned with play therapy where the available materials, equipment, and the therapist's rôle are relatively constant (12). Thirdly, many of the children involved in the study had inadequate social contacts and neurotic traits. Such factors may well have retarded the children to the extent that their chronological age was not representative of their level of maturity. Lastly, the question of the suitability of young children of various age levels was not considered. Slavson and his coworkers are now ". . . exploring the possibilities for organizing [such] play groups . . ." (20, p. 328).

The need for experimental evidence on the matter of age and suitability for nondirective play therapy seems obvious.

B. METHOD

1. *Considerations*

The development of verbalized insight no longer occupies the paramount position it once held in nondirective philosophy (10). Nonetheless, in view of the wealth of verbatim material published in texts and articles on nondirective play therapy, speech productions are still important indicators of therapeutic success. The amount of verbal productivity of the child in relation to the length of the therapist's speech is often regarded as indicative of therapeutic success. If the child speaks little it is felt that successful communication has not been established and that the therapy is headed for failure. Speech in therapy would seem to be an adequate index of therapeutic suitability. The present writer realizes that children who do not speak, or overtly participate in any way in play therapy, can be benefited. Determining the suitability of such children for nondirective play therapy is a difficult matter. At present such children are best considered as they are usually presented—in the guise of a unique, single case history.

An adequate age range for investigating the question of therapeutic suitability must also be considered. It has been noted that: "The three-year-old finds it hard, because of his imperfect physical coördination to do two *motor* things at once, such as eating and talking, or dressing and talking" (6, pp. 176-177). Since speech is the chosen index of therapeutic suitability for this investigation, children who could not play and talk at the same time would not make suitable candidates for play therapy. The four-year-old child can perform two simultaneous motor acts (6). It has also been remarked that, "It is during this period (four-and-a-half to six years of age) that the child's personality takes on definite structure, in contrast to the diffuse, undifferentiated picture he presented earlier" (5, p. 3). Consequently, for investigating age and suitability for nondirective play therapy it does not seem necessary to select children younger than four years of age for inclusion in the experiment.

The lower limit of suitable age has been established by the maturational process. As for the upper limit of age—the present writer prefers to use his measuring "thumb" and select children of approximately 12 years of age.

Since the technique of nondirective play therapy is relatively constant, the same toys are available for use by all age levels. (The contribution of toys to the nondirective play therapy process has been discussed more fully elsewhere (13, 15).) For present purposes it should be noted that children's play activities and time spent in play decrease as age advances. Consequently, it may be assumed that the toys generally available in nondirective play therapy will not be used as an aid to communication by the 12-year-olds to the extent that they are employed by younger age groups.

This assumption may be tested on the basis of normative data gathered in previous investigations (9, 13). In view of the importance of the question of age as a criterion of suitability for nondirective play therapy it appears worth while to state a specific hypothesis and reexamine the normative data.

2. *Hypothesis*

Children 12 years of age will make fewer statements while using either recommended or nonrecommended toys, than will children at younger age levels.

3. *Subjects*

The normative data consisted of 4,092 statements made by 20 children, 10 of each sex, selected as being socially, intellectually, and chronologically satisfactory. A child considered chronologically representative could not vary more than four months from the age of 4, 6, 8, 10, or 12 years. There were four children in each of these age groups. Normal social adjustment was determined by examining cumulative records and by interviews with teachers. To be considered intellectually satisfactory, a child's Stanford-Binet *IQ* score could not vary more than one sigma from the normal *IQ* of 100.

4. *Methodology*

Three, one-hour, therapy sessions were done with each child by the same therapist in the same room. The same toys, or identical ones, were used in every play session. The following recommended toys appear on the published lists of one or more therapists: Airplanes, a variety of animals, dolls, balloons, blackboard and chalk, boats, nursing bottles, bow and arrows, brooms, several types of cars, clay, cloth or rags, clothesline and clothespins, crayons, cups and saucers, hand puppets, doll beds, a doll house completely furnished and a doll family, guns, hatchets and knives of rubber, mallets, masks, paints of various kinds, paper dolls, peg board for pounding, pencils, doll bed equipment, sand, scissors, shovels, spoons, telephone, toy soldiers, water, and wooden sticks and blocks of different sizes. The nonrecommended toys were: Rubber balls, bubble blowing equipment, checker game, coffee pot, coloring books, comic books, cord or rope, film viewers with film strips, fireman's helmet, ladies' hats, handcuffs, hoe, magazines, marbles, play money, paper pumpkin, rake, ladies' shoes, stand-up-figures of Peter Rabbit, his family, and Farmer Brown, man's sweater, thumbtacks, washboard, and a whistle.

By using the same toys, room, and therapist the materials and therapeutic rôle remained constant for all of the subjects. Further, the children of the present study were normal. Their chronological age was, presumably, more representative of their maturation level than were the children of a previous study (4). By including four-year-olds in the sample it was possible to examine the low end of the continuum of chronological suitability for nondirective play therapy.

As each child behaved in the playroom, verbatim and descriptive style records were made of his actions. The children's verbalizations were then categorized according to a method described in this JOURNAL (14). In the present paper categorized verbalizations are referred to as "statements."

C. RESULTS

The frequency of statements made while recommended or nonrecommended toys were used as well as the frequency of statements made while the children were not playing with toys are shown at each age level in Table 1.

TABLE 1

AGE LEVEL, TOTAL CATEGORY USE, PERCENTAGE OF TOTAL CATEGORY USE, AND CATEGORY USE AND PERCENTAGE OF CATEGORY USE WHEN PLAYING WITH RECOMMENDED TOYS, NONRECOMMENDED TOYS, OR NOT PLAYING WITH TOYS

Age level	Total statements	Total statements %	Rec. toys	Rec. toys %	Nonrec. toys	Nonrec. toys %	No toys	No toys %
4	1,131	27.62	731	28.34	152	26.16	248	26.61
6	863	21.09	544	21.09	86	14.80	233	25.00
8	891	21.77	515	19.97	198	34.08	178	19.10
10	759	18.55	588	22.80	74	12.74	97	10.41
12	448	10.95	201	7.79	71	12.22	176	18.88
Total	4,092	99.98	2,579	99.99	581	100.00	932	100.00

There were 38 or more recommended toys available and approximately 23 nonrecommended toys. To equalize the number of statements made under the three conditions of play the frequencies have been converted to percentage figures. These data are also available in Table 1.

D. DISCUSSION

As can be seen from an examination of Table 1, fewer statements were made at the 12-year level with recommended and/or nonrecommended toys than at any other age level. The hypothesis has received support.

The differences are even more apparent where percentage figures have been employed. The lowest percentage of statements made while playing with recommended toys or with nonrecommended toys is found at the 12-year level. The 12-year-olds also spoke least in the nondirective play therapy situation.

The findings suggest that toys do not adversely affect the frequency of verbalizations at age levels 4 through 10. However, recommended toys seem to sharply lose their effectiveness at the 12-year level. The unpopularity of recommended toys is not a gradually developing process. It seems to appear suddenly. Such toys do not even seem to make the therapy hour palatable among 12-year-old children. With nonrecommended toys, however, the difference is neither so precipitous nor so marked. Children 12 years old do not seem to be as adverse to some toys as they do to the usual or "recommended" toys of nondirective play therapy.

This unpopularity of the usual toys may be one reason nondirective play therapy has been believed to be ineffective with children entering their teens. The toys usually found in the playroom evidently do not encourage them to verbalize. Indeed, in the present writer's experience, the sight of "baby" toys dissuades 12-year-olds from speaking. They seem to feel such toys are beneath them, and that the playroom is not theirs. Consequently, children who have reached the age of 12 do not seem to be suitable for present day nondirective play therapy.

Slavson's words, "as we move on in terms of age, we find that we must vary the materials . . ." (19, p. 207), may contain the answer to interesting children 12 years of age and older in the nondirective playroom. He suggests that as the child grows older more difficult materials be introduced. The present writer suggests that future research on 12-year-olds and older might contrast verbalizations made in a playroom containing special toys for those ages with a straight face-to-face counseling situation in a room without toys. The toy room might contain, for example, hand puppets, marionette sets, science materials, construction sets, electric train equipment, patterns and materials for simple clothes making, cosmetic kits, as well as painting, modeling, and more difficult creative equipment. Our present collection of toys may be driving the 12-year-olds from the playroom.

E. SUMMARY

Children's statements, 4,092 in number, made in 60 individual nondirective play therapy sessions by 20 normal children aged from 4 to 12 years were used. It was found that fewer statements were made while playing with toys at the 12-year level than at levels of 4 to 10 years of age. It was said that nondirective play therapy toys seemed to restrict the speech of 12-year-olds. Consequently, children reaching this age level did not seem to be suitable for present day nondirective play therapy.

It was suggested that certain other toys than those usually found in the nondirective play therapy room might make children 12 years of age and older feel more at home in the playroom. A plan for future research along this line was suggested.

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The Journal of Genetic Psychology, 1956, **89**, 239-249.

AN ASSESSMENT OF PERSONAL-SOCIAL ADJUSTMENTS OF A GROUP OF MIDDLE-CLASS MOTHERS*

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A. INTRODUCTION

The question of how and from whom children learn various aspects of their social behavior has been of increasing interest to psychologists concerned with human development. The child's interaction with his primary social group, and especially with his mother, has been suggested to be particularly relevant to his social development. Evidence for this has come more frequently from clinical observations derived from therapy with neurotic adults or with children having behavior problems than from controlled observations of normal individuals.

Previous research on child-socialization at the Fels Institute for Research in Human Development (1, 2, 3, 4, 5, 8, 9) has dealt with normal mothers interacting with their children, with particular emphasis on the isolation and description of child-socialization techniques employed by these mothers. Current psychological research at Fels is directed, not only toward a more complete understanding of specific maternal child-socialization techniques, but also toward the investigation of the mother's own adjustment as it may relate to her maternal behavior and the social development of her children. The present study is a preliminary one concerned with the description and measurement of personal-social adjustments of a group of normal mothers as reflected in their interactions with their husbands, their children, and their immediate friends, and in their behavior in general community situations.

The study dealt with the following questions: (*a*) How well can the levels of general personal-social adjustment of normal women be differentiated through ratings made from home visit observations? (*b*) What intra- and inter-rater agreement results from such a method? (*c*) How consistent are the rated adjustment levels of normal women over a period of several months? (*d*) What relationship exists between the socio-economic status of the mothers and ratings of their adjustment levels? (*e*) What specific

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*Received in the Editorial Office on June 26, 1955.

[1] The authors are grateful to Dr. Jean Kalhorn Lasko who as a Fels Home Visitor, acted as a rater in the present study, and to Mrs. Ursula Bellugi for her aid in data analysis.

aspects of the mothers' behavior are particularly relevant to their rated general adjustment levels?

B. METHOD

1. *Subjects*

Seventy-four subjects were used in various aspects of the study. They were white married females, mothers of one or more children. They were all in the normal range of personal-social adjustment in that they were at least coping with the exigencies of their day-to-day living. The subjects, members of the Fels longitudinal research population, were originally secured by voluntary application. The main criterion for acceptance as Fels subjects was the likelihood of permanent residence in the vicinity. Like the total Fels population, the sample was composed of women living in industrial centers, small towns, and on farms within a 30-mile radius of the Fels Institute. An inspection of Table 1 indicates that most of the mothers were between 35 and 50 years of age, had from two to five children, belonged to the middle socio-economic class,[2] and were considerably more intelligent and better educated than the national averages.

TABLE 1
CHARACTERISTICS OF SAMPLE

Age	*N*	Children	*N*	*IQ*	*N*
50 and over	8	More than 4	3	135 and over	4
45-49	16	4	15	130-134	14
40-44	17	3	23	125-129	9
35-39	21	2	27	120-124	12
30-34	6	1	6	115-119	18
25-29	6			110-114	9
	74		74	105-109	3
				Below 105	1
				Not available	4
					74

Education	*N*	Index of status characteristics	Corresponding social class	*N*
Some College	46	Below 24	Upper	2
High school graduates	20	25-35	Upper middle	14
1 to 3 years *HS*	4	36-52	Lower middle	49
Grammar school	1	53-64	Upper lower	9
Not available	3			
	74			74

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[2] The Index of Status Characteristics, developed by Warner, *et al.* (10), was used to rate the socio-economic status of the subjects.

2. *Observations*

All ratings were made by two Fels Home Visitors. Both Home Visitors were experienced clinical psychologists who, as part of the continuous Fels Home Visit Program, had regularly visited the homes of the subjects. During these visits, interviews, direct observations, and informal conversations were used as occasions presented themselves to elicit relevant information.

3. *The Rating Scale*

The general format of the rating scale of personal-social adjustment used in the present study was patterned after the Fels Parent Behavior Rating Scales (4, 5). As with those scales, the rating scale consisted of a description of the variable, descriptive cue-point phrases along a 90-millimeter line, and a method for graphic subject-to-subject comparison.

Instructions to the raters were:

> Rate the general adjustment of the mother in her day-by-day relationships. This rating should include the degree to which: (*a*) her behavior is effective in satisfying her needs; (*b*) she is resilient and adaptable in the face of new situations; (*c*) she evidences emotional stability and personal security; (*d*) she is free of the excessive use of defense mechanisms such as projection, rationalization, and repression; (*e*) she is free of symptomatology indicative of maladjustment. This is a broad variable including the existence of, or freedom from, conflict with persons, among needs and motives, or with obstacles. This variable includes the mother's perception of her adjustment as well as her observable interaction with relevant persons in her environment and the manner in which she carries out her various activities.

4. *Verbal Descriptions*

Subsequent to the ratings each rater was independently interviewed by the senior author. The rater discussed each mother's level and kinds of adjustment in: (*a*) the mother's general methods of dealing with day-to-day situations and her attitudes toward this behavior; (*b*) her interactions with her husband; (*c*) her maternal behavior; (*d*) her relationships with friends and with people in the general community; and (*e*) her specific interaction with the rater during home visits. The raters' descriptions were electrically recorded and typed for subsequent analysis.

5. *The Rating Schedule*

Table 2 summarizes the rating schedule. At the time of the first ratings, Rater *AP* had previously made two home visits to each of the mothers, while Rater *JKL*, who had been a Fels Home Visitor for nine years, had much more extensive knowledge of the subjects. Rater *JKL* rated 74 mothers in the first rating session and Rater *AP* separately rated 48 of these mothers. The rating sessions followed the completion of home visit observations of all mothers. Such a procedure obviously allowed for differing amounts of time between the last home visit observations of various mothers and the rating session but had the advantage of simultaneous subject-to-subject comparison of all mothers at the time of the rating.

TABLE 2

SCHEDULE OF RATINGS

	1st rating	2nd rating	3rd rating
Basis for rating	Observations in the home	Memory	Additional home observation
Time of rating	At completion of home observations	6 weeks after 1st rating	10 months after 1st rating
Number of subjects rated by each rater	*AP* $N = 74$ *JKL* $N = 74$	*AP* $N = 48$ *JKL* = None	*AP* $N = 40$ *JKL* = None

Rater *AP*'s second set of ratings was made from memory six weeks after her first ratings without any intervening home visit observations.

Rater *AP*'s third set of ratings, on 40 of her original 48 mothers, was made 10 months after her first ratings and after one additional home visit observation. The home visits upon which her first ratings were based preceded that rating session by a median of four months and 13 days and had a semi-interquartile range of one month and 22 days. The home visit observations for *AP*'s third ratings preceded that rating session by a median of one month and 18 days and had a semi-interquartile range of one month and 5 days. Thus, *AP*'s first and third rating sessions were separated by 10 months and were based on observations most of which were separated by about one year.

C. RESULTS

1. *How well can the general personal-social adjustment levels of normal women be differentiated through ratings made from home observations?* The one set of ratings made by *JKL* and all sets of *AP*'s ratings were analyzed for the range and shape of the distribution of their scores. The graphic rating scale of adjustment was 90 millimeters, giving a potential range of scores from 1 to 90. *JKL*'s scores ranged from 1 to 86. *AP*'s first ratings ranged from 10 to 83, her second ratings from 16 to 81, and

her third ratings from 9 to 81. Thus, in general the scale's cue-point descriptions were adequate to establish a large range of scores. All series of ratings were tested for the normality of their distributions by Fisher's g-statistics (7, pp. 153-158). All of rater *AP*'s ratings were normally distributed. Rater *JKL*'s ratings were significantly platykurtic beyond the .01 level. Thus both raters placed subjects along the greater part of the scale and neither left an excessive bunching of subjects centering around the midpoint of the scale.

Such distributions, of course, could result from chance errors. To test whether these distributions were due to chance or to intrinsic between-subject differences, Jackson and Ferguson's method of estimating the sensitivity of a test (6) was applied to the ratings. This method was used to compare rater variance, between-mother variance, and error variance. The 40 mothers held in common in all sets of ratings were used in this analysis. Tables 3, 4, and 5 summarize the data.

Tables 3 and 4 indicate that intra- and inter-rater variance were not sig-

TABLE 3
ANALYSIS OF VARIANCE OF RATERS *JKL* AND *AP*'S FIRST PERSONAL-SOCIAL ADJUSTMENT RATINGS OF 40 FELS MOTHERS

Source of variance	*df*	Sum of squares	Mean squares	*F*	*P*
Between raters	1	5.00	5.0	.004	N.S.
Between mothers	39	27,104.20	694.98	5.05	<.01
Error	39	5,363.00	137.51		
Total	79	32,472.20			

TABLE 4
ANALYSIS OF VARIANCE OF RATER *AP*'S FIRST AND MEMORY RATINGS OF THE PERSONAL-SOCIAL ADJUSTMENT OF 40 FELS MOTHERS

Source of variance	*df*	Sum of squares	Mean squares	*F*	*P*
Intra rater	1	46.51	46.51	1.66	N.S.
Between mothers	39	24,274.89	622.43	22.71	<.01
Error	39	1,089.99	27.95		
Total	79	25,411.39			

TABLE 5
ANALYSIS OF VARIANCE OF RATER *AP*'S TWO SETS OF OBSERVATIONAL RATINGS OF THE PERSONAL-SOCIAL ADJUSTMENT OF 40 FELS MOTHERS

Source of variance	*df*	Sum of squares	Mean squares	*F*	*P*
Intra rater	1	756.45	756.45	8.85	.01
Between mothers	39	26,083.05	668.80	7.83	.01
Error	39	3,332.05	85.44		
Total	79	30,171.55			

nificant factors when ratings were based on the same observations of the mothers. Table 5, in contrast, indicates that when ratings are based on different observations of the mothers and were separated by a period of time, rater variance was a significant factor. Since *AP*'s total knowledge of the mothers at the time of her first rating was based on a very small number of previous observations, the significant rater variance in Table 5 may be attributable to the rater's level of experience with the mothers as well as intrinsic temporal fluctuations in the mothers' adjustment levels.

In answer to the original question it can be seen that in all sets of ratings the raters were sensitive to the individual differences in the mothers' ratings, e.g., between-mother variance was significantly greater than error variance.

2. *What was the intra- and inter-rater agreement?* Forty-eight mothers were rated by both *AP* and *JKL*. Inter-rater agreement[3] was .69. Rater *AP* followed her first rating with a memory rating six weeks later. Her intra-rater agreement on these two sets of ratings was .89. These two correlations suggest that the quantification of home visit observations through the use of the rating scale resulted in moderate inter-rater agreement and high intra-rater reliability.

3. *How consistent were the rated adjustment levels of the mothers over a period of several months?* The correlation between *AP*'s first and third ratings was .78. Thus, as reflected in the observation and rating procedures used, the mothers' levels of adjustment were fairly consistent over a period of approximately one year.

4. *What relationship existed between the socio-economic status of the mothers and ratings of their adjustment levels?* To answer this question, *JKL*'s adjustment ratings of 74 mothers were correlated with the mothers' socio-economic status as measured by the Index of Status Characteristics. The correlation was .30, significant beyond the .01 level. Mothers of higher socio-economic status were rated as better-adjusted than mothers of lower socio-economic status. It will be remembered, as shown in Table 1, that the subjects were a fairly homogeneous group with respect to socio-economic status. Most of the mothers fell in the middle class and a large portion of these in the lower middle class. Thus, while the relationship between status and adjustment ratings was low, it cannot be ignored. It is conceivable that a broader range of socio-economic status might have resulted in a larger relationship. That such might be the case is suggested when the extremes of the status distribution are inspected. Of the 10 mothers with

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[3] All correlations, unless otherwise stated, were Pearson *r*'s run on McCall *T*-scored data.

the highest socio-economic status, eight were above the mean adjustment score for the total group. Of the 10 mothers with the lowest socio-economic status, seven were below the mean adjustment score. From the data at hand it was not possible to ascertain why such a relationship existed. The data does, however, suggest that socio-economic status cannot be ignored in research concerned with personal-social adjustment.

5. *What specific aspects of the mothers' behavior were particularly relevant to their rated personal-social adjustment levels?* Each rater described her observations of each mother in an interview with the senior author. The senior author subsequently analyzed *JKL*'s recorded interviews for specific indicators of high and low adjustment in each area of the mothers' social interaction. An adjustment score was obtained for each social area by scoring all behavioral referents in a given area indicating high or low adjustment as plus or minus accordingly. The scoring unit for a given behavioral referent was defined as any reported feeling state, attitude, or behavior of the mother in her interaction with one specific person or group of persons.[4] The mother's score for each area was the algebraic sum of all scorable behavioral units for that area.

Contingency coefficients were run between the social area scores and the personal-social adjustment ratings of all 74 mothers. Cutting points used were a *T*-score of 50 for the adjustment ratings and the median score for each of the social areas. With .71 as the maximum contingency coefficient for two-by-two relationships, the personal-social adjustment ratings were related to the social area scores as follows: (*a*) with the mothers' general methods of dealing with day-to-day situations, .57; (*b*) with their behavior toward friends and in general social situations, .50; (*c*) with their interactions with their husbands, .48; (*d*) with their maternal behavior, .43; and (*e*) with their interactions with the rater, .42. Chi-square tests between the social area scores and the adjustment ratings were all significant beyond the .01 level. Thus, observations of the mothers' behavior in all social areas investigated, as described by Rater *JKL* and scored by the senior author, were significantly related to the mothers' rated general adjustment levels. The descriptions of the mothers were also analyzed to ascertain the specific aspects of their behavior which were especially related to their rated levels of adjustment. Since the rater descriptions were unstructured, a given variable was not applied at all 74 mothers but only to those whom the rater felt it especially characterized. In the summary which follows the variables will be described one at a time and will be followed by two numbers in parentheses. The first will indicate the number of relatively well-adjusted mothers who were described in terms of the variable; the second will indicate the number of relatively poorly-adjusted mothers who were so described. The adjustment-rating T-score of 50 was used to divide the 74 mothers into a relatively well-adjusted group and a relatively poorly-adjusted group, each containing 37 mothers.

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[4] A more complete description of this method and its utility for the analysis of various kinds of data will be published in a separate article.

(*a*). *General Behavior.* Well-adjusted mothers were more frequently described as having stable value systems (13-3). They were less prone to have unrealistic perceptions of themselves and their environment (2-9). Mothers in the adjusted group were more often pictured as happy (characteristically happy, 7-0; characteristically unhappy, 1-11), more enthusiastic (8-1), and more satisfied with themselves and their surroundings (generally satisfied, 11-1; chronically dissatisfied, 1-9). Adjusted mothers tended to be more competent in meeting the exigencies of their daily life (15-4) and also felt more adequate in these situations (general feelings of adequacy, 10-1; pervasive feelings of inadequacy, 3-15).

Fewer adjusted mothers were described as having a consistent social facade (7-15). The raters described what they meant by a social facade in such statements as, "She always keeps you at a distance," or "I very rarely feel she is expressing personal thoughts or feelings." In addition it was noted that, of those mothers who did maintain a facade, the better-adjusted mothers were more often described as shy and stiff while the defensive quality of the facades of the less-adjusted mothers was more apparent.

Very few mothers were described as characteristically anxious, worried, or fearful. There was no relationship between adjustment level and the occurrence of such behavior in the mothers who were so described (4-5). Inspection of the descriptions of these mothers suggested, however, that the pervasiveness of the insecurity was not as differentiating as its quality. The better-adjusted mothers pictured as insecure could be more accurately characterized as women who chronically worried about specific minor problems. In contrast, all of the mothers in the less-adjusted group described in terms of this variable were typified by relatively generalized anxiety.

(*b*). *Behavior with friends and in general social situations.* Better-adjusted mothers were more frequently described as being particularly active in social affairs (10-3). Women in the well-adjusted group more often had many close friends (21-11). In contrast women who had no known close friends belonged exclusively to the poorly-adjusted group (0-10). The better-adjusted mothers were more comfortable and effective in their affiliational and social relationships (with friends, 17-1; in social activities, 10-4).

The kinds of relationships the mothers established with their friends appeared to be associated with their own general adjustment. Better-adjusted mothers were more prone to develop close, yet free, associations with friends (13-0), while less-adjusted mothers tended to establish either very superficial alliances or to enter into clinging, dependent ones (5-10).

(*c*). *Interaction with the Home Visitor.* The mothers' adjustment levels were related to the kinds of relationships they attempted to establish with the Home Visitor. Better-adjusted mothers tended to establish free and warm relationships with the rater (30-11), while less-adjusted mothers either reacted in terms of a defensive social distance or by attempting to develop a dependent relationship with the Home Visitor, making her a confidante for their problems (5-20).

(*d*). *Relationship with husband.* Better-adjusted women were more frequently described as having interests and activities in common with their husbands (11-1). A relationship was also found to exist between the adjustment levels of the subjects and mutual expressions of affection and respect between husband and wife. The marital interactions of adjusted women were more frequently characterized as having a high degree of mutual respect (8-2) and affection (12-2). In contrast, less-adjusted women were more critical of, and deprecatory toward, their husbands and felt that their husbands reciprocated in kind (3-11).

(*e*). *Maternal behavior.* Relationships between the mothers' own adjustments and their maternal behavior appeared more complicated. For ininstance, when the Home Visitor noted mothers who used especially coercive child-socialization techniques, this behavior was not related to the mothers' own adjustment level (6-4). It seemed, rather, to be more directly related to the mothers' cultural values, e.g., almost all of the mothers who used especially coercive techniques were rural rather than urban mothers.

The mothers' levels of adjustment were complexly related to the nurturant aspects of their maternal behavior. Mothers described as giving optimum protection and support to their children were generally well-adjusted (6-1), and mothers characterized as especially lacking in nurturant behavior tended to be less-adjusted (1-5). Overprotective mothers, however, were found as frequently in the adjusted as less-adjusted groups (7-6). This does not agree with reported clinical observations that maternal overprotection is especially evident in maladjusted women. It may be that such a relationship often exists in neurotic mothers but that overprotection may be unrelated to the level of adjustment of normal women.

No relationship was found between the mothers' adjustments and the degree to which they expressed disapproval and criticism of their children's behavior (12-9). Inspection of the data suggested that, while the amount of child-disapproval was unrelated to the mothers' adjustment, the nature of this disapproval was characteristically different. Better-adjusted mothers were usually dissatisfied with specific aspects of their children's behavior or rate of development while less-adjusted mothers were more often critical and rejecting of their children as individuals.

Better-adjusted mothers were described as expressing more warmth and affection toward their children (22-8). Mothers in the adjusted group were also found to have more general acceptance of their maternal rôle (general rôle acceptance, 10-1; rôle dissatisfaction, 6-14).

The foregoing summary of Home Visitor observations is, of course, suggestive only. The validity of these observations awaits more definitive testing in subsequent research.

D. SUMMARY

The present investigation was essentially exploratory. It was primarily concerned with the description and measurement of various personal-social adjustments of a group of normal middle-class mothers.

A personal-social adjustment rating scale was developed to quantify home visit observations of the mothers. Ratings using this scale were found to result in moderate inter-rater agreement and high intra-rater reliability. In all sets of ratings, the raters were found to be sensitive to the individual differences in the mothers rated. The adjustment levels of the subjects, as reflected in the observations and rating procedures used, were found to be relatively stable over a year's time.

It was found that mothers with higher socio-economic status tended to be rated as better-adjusted than mothers with lower socio-economic status.

Relationships between the mothers' rated levels of personal-social adjustment and their observed adjustments in specific interpersonal areas were analyzed and discussed.

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The Journal of Genetic Psychology, 1956, **89**, 251-262.

WISC SCORES AND STATUS IN READING AND ARITHMETIC OF DELINQUENT CHILDREN*

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A. INTRODUCTION

The present study follows a long line of investigations concerned with the mental abilities and scholastic achievements of children and adolescents referred to juvenile courts or institutionalized for delinquency. Relevant findings from these studies may be summarized as follows:

1. Young delinquents as a group are characterized on the average as dull normal or low normal in general intelligence (1, 3, 4, 5, 6, 7, 11, 12, 15, 22, 23, 24, 25, 26, 27, 31).
2. Their record on performance tests is close to normal, surpassing their verbal attainments (2, 9, 29, 31).
3. In the above respects they tend to resemble non-delinquent groups whose economic and social level is similar to their own (16, 25).
4. Their retardation in general (or verbal) intelligence is not as great as their retardation in school achievement, especially such fundamentals as reading and arithmetic (1, 7, 10, 12, 13, 16, 19, 20).

Wechsler's outlining of a pattern of Wechsler-Bellevue subtest scores characteristic of adolescents with psychopathic personality (29, p. 149) introduced a new line of approach to the problem, and has been followed by a number of other studies involving variations of such analysis (8, 16, 19, 20).

An outstandingly well-controlled and wide-ranging attempt at "unraveling juvenile delinquency" is the recent study by Glueck and Glueck (16) conducted with support from the Commonwealth Fund and a number of other grants. These investigators have paired 500 delinquent boys with 500 non-delinquents, matching them in respect to age, Wechsler Full-Scale *IQ*, national (ethnico-racial) origin, and residence in underprivileged neighborhoods. With these four factors matched in the two groups, they have found some differences between the groups in Wechsler subtest scores, significant differ-

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*Received in the Editorial Office on June 30, 1955.

[1] The Authors are indebted to Dr. Ralph Brancale for giving access to the case records of the New Jersey Diagnostic Center, and to Dr. Milton L. Kleinman and Dr. Nelson G. Hanawalt for advice and assistance.

ences in reading and arithmetic quotients on the Stanford Achievement Test, and even more pronounced differences in the record of scholastic achievement as reported by the schools.

Modestly joining this long line of predecessors, the present study finds justification rather more in its contribution to method than in its analysis of one more sample of young delinquents. The Wechsler Intelligence Scale for Children (30) was employed as the measure of intelligence, and reading and arithmetic scores were transmuted into standard scores directly comparable to the *WISC* subtest scores.

B. SUBJECTS AND PROCEDURE

Permission was granted to use the psychological files of the New Jersey Diagnostic Center at Menlo Park, New Jersey. The children who are sent to the Diagnostic Center are usually court referals. Children aged eight through 18 are accepted as inpatients. A child may remain for a maximum of 90 days, during which time he is subject to psychological examination and to careful supervision and observation. Recommendations are made to the court on the basis of the study.

The 435 cases recorded from June, 1950, through mid-December, 1951, were reviewed. The 105 cases selected for study were those who had been given both the *WISC* and Gray's Standardized Oral Reading Paragraphs (17). Many of these children had also been given part or all of the Stanford Achievement Test (21), Form *D*, which yields scores in reading and arithmetic. The Average Reading grade score (comprising Paragraph Meaning and Word Meaning) and Average Arithmetic (including Arithmetic Reasoning and Arithmetic Computation) were utilized for the 65 cases in which these tests had been given in full and in the standard procedure requiring the child to read the test materials and write his answers. Where it was evident that the Stanford test had been given orally, the results were not included.

To make it possible to compare the *WISC* subtest scores with the reading and arithmetic scores it was necessary to change the grade levels into transmuted standard scores following the model of the *WISC* subtest scores, with the mean *for the child's age* set at 10 points and with a standard deviation of three points.

There were 68 regular Gray *B*-scores, giving the grade level (from Grade 1.4 to Grade 8.0) corresponding to the raw test score. *B*-scores were assigned to the remaining 37 cases by the following methods. Three scores were extrapolated. Eight cases had been recorded as "— -grade work in reading." The lowest *B*-score for the grade mentioned was assigned as the level in these cases. In 23 cases the records indicated that the child was unable to read the material of the Gray test (a total reading disability). These cases were arbitrarily assigned a grade level of 1.2, which is one step below the lowest *B*-score level.

Transmuted standard scores corresponding to the Gray reading levels were then computed in the following manner. The table of *CA* corresponding to grade level given in the Manual of the 1950 California Short-Form Test of Mental Maturity (28) was used to convert the Gray grade level into an age equivalent in months.[2] This age equivalent will be referred to hereafter as the child's Gray Reading Age. The assumption was then made that the mean Reading Age at a given *CA* should equal the *CA*, and that the *SD* of the Reading Ages at a given *CA* should equal 0.15 times the *CA*, so that the *SD* of the Reading Quotients might be 15, comparable to the *SD* established for the *WISC IQ*s. The deviation of an individual's Reading Age from the norm for his age (i.e., the individual's Reading Age minus his *CA*) was divided by the hypothetical *SD* of the Reading Ages at that *CA* (i.e., by 0.15 times the *CA*) to yield the individual's standard score or *z*-score. The *z*-score was then transmuted to a scale with the mean set at 10 points and the *SD* at 3. The procedure is expressed in the following formula:

$$X_2 = M_2 + SD_2 \frac{X_1 - M_1}{SD_1}$$

where,

X_2 = transmuted standard score (later designated as *W*-score)
M_2 = assigned mean
SD_2 = assigned standard deviation
X_1 = Gray Reading Age
M_1 = Chronological Age
SD_1 = assumed standard deviation of Reading Ages at *CA*; i.e., 0.15 M_1

The Stanford reading and arithmetic scores, recorded in grade levels, were changed into transmuted standard scores by the same method, using the 1950 California Short-Form tables so as to make them comparable to the Gray scores. The transmuted standard score shows the place of the age equivalent of the grade level in the hypothetical distribution of achievement ages in the child's chronological age group. These transmuted standard scores will hereafter be referred to as *W*-scores, to signify their comparability to the *WISC* subtest scores.

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[2] The California tables fall midway between the Stanford Modal-Age-Grade equivalents, which assign somewhat lower ages to the several grades, and Gates' tables (14, p. 604) which assign higher ages.

In using this method with the 27 cases where the *CA* was above 13-6, allowance was made for the lack of direct correspondence between mental growth and increasing years which sets in at this age. Each month of *CA* between 13-6 and 16-6 was counted as 0.2 month. The adjusting factor of 0.2 was calculated from Wechsler's table of smoothed mean standard scores corresponding to his *CA* groups (29, p. 120). From 9-6 to 13-6 there were 41 points of increase in standard score, a rough average of 10 points per year. From 13-6 to 16-6 there were six points of increase in standard score, an average of two points per year. In other words, when viewed with reference to the period 9-6 to 13-6, each year in the period 13-6 to 16-6 counts as 0.2 year. This adjustment, admittedly crude, may be considered adequate for the purposes of this study. The *SD* of the distribution of achievement ages at an adjusted *CA*, or at its corresponding normal achievement age, was considered to be 0.15 times the adjusted age. For the oldest individual in our sample, a boy with a *CA* of 16-0, it was thus assumed that the normal achievement age for him would be 14-0 (168 months), with the *SD* 25.2 months. As his Gray Reading Age was 116 months, his *z*-score was —2.06, and his Gray *W*-score was 3.82.

The chronological ages of the 105 children in the sample ranged from 8-4 to 16-0, with the median at 12-4. There were 15 girls and 90 boys. The difference between the mean Full Scale *IQ* for the girls and the boys is not statistically significant, and they have been treated as a single group.

C. Results

The distribution of Full Scale, Verbal, and Performance *IQ*s is presented in Table 1. The mean Full Scale *IQ* of 88.4 falls in Wechsler's Dull Normal category (30, p. 16), differing significantly from the mean for his normative group ($P < .01$). In the *IQ* categories below 90 are found 52.3 per cent of our group as compared with 25 per cent in the normative sample. The mean Performance *IQ* (92.4) is significantly higher ($P < .01$) than the mean Verbal *IQ* (87.0). The correlation of .76 between these two sets of scores was taken into account in computing the significance of the difference.

Table 2 lists the means and *SD*s of all the test scores of our sample, and the number of cases in the sample for each score. All means and *SD*s, in-

TABLE 1
DISTRIBUTION OF *WISC* FULL SCALE, VERBAL, AND PERFORMANCE *IQ*S OF 105 DIAGNOSTIC CENTER CASES

IQ	Number of cases Full Scale	 Verbal	 Performance
130 and above	1		2
120-129	1	1	5
110-119	8	9	13
90-109	40	37	37
80- 89	27	24	28
70- 79	18	22	10
69 and below	10	12	10
Mean	88.4	87.0	92.4
SD	16.6	15.0	18.2
Mean Diff.		5.4	
r		.76	
t		4.62	
P		$<.01$	

TABLE 2
MEANS AND STANDARD DEVIATIONS OF *W*-SCORES OF DIAGNOSTIC CENTER CASES
(To be compared with a normative group in which $M = 10$ and $SD = 3$.)

Test score	Number of cases	Mean	*SD*
WISC Full Scale *IQ* (transmuted)	105	7.69	3.31
WISC Verbal *IQ* (transmuted)	105	7.41	2.99
WISC Performance *IQ* (transmuted)	105	8.49	3.65
WISC Information	105	7.42	2.81
WISC Comprehension	105	8.64	3.18
WISC Arithmetic	104	7.63	2.53
WISC Similarities	105	8.42	3.16
WISC Vocabulary	90*	7.12*	2.78
WISC Digit Span	50†	8.14†	2.70
WISC Picture Completion	105	9.30	3.68
WISC Picture Arrangement	105	9.33	3.69
WISC Block Design	105	8.71	3.63
WISC Object Assembly	104	9.51	3.08
WISC Coding	100	7.70	3.25
Gray Reading	105	4.73	3.58
WISC Full Scale *IQ* (transmuted)	65‡	8.12‡	2.86
Gray Reading	65‡	5.22‡	3.47
Stanford Reading	65	5.71	2.65
Stanford Arithmetic	65	5.11	1.75

*The mean for Vocabulary might be slightly higher if the total sample of 105 had been tested. Mean Full Scale *IQ* of the 15 cases without Vocabulary scores was 96.6; mean for those with Vocabulary scores was 87.0; difference significant at .05 level.

†Sample given Digit Span subtest is not significantly different from sample not given this test.

‡Mean Full Scale *IQ* and mean Gray Reading *W*-score of the 65 cases with complete Stanford Reading and Arithmetic scores from tests given by standard procedure are somewhat higher than the corresponding means of the 40 cases without such Stanford scores. Difference between Gray means is significant at .10 level; *IQ* difference is less significant.

cluding those for *IQ*s, are in comparable terms, being cast in units like those of the *WISC* subtest scores. They are to be considered in relation to a normative mean of 10 and a normative *SD* of 3. The list of means may be regarded as a profile of the abilities of the Diagnostic Center sample. All means fall below the normative mean, but the highest point (9.51 in the Object Assembly subtest) is only 0.16 sigma below the mean, whereas the lowest point (4.73 for the Gray Reading *W*-scores of the entire sample) is 1.76 sigma below the norm. The Object Assembly mean is not significantly different from the norm ($P > .10$), and the means in Picture Completion and Picture Arrangement barely approach a significant difference from the norm ($P > .05, < .10$). The differences between all other means and the norms are significant at the .01 level or better.

TABLE 3

SIGNIFICANCE OF DIFFERENCES BETWEEN MEANS

Tests	No. of cases	Mean *W*-Score	*r*	*t*
WISC Full Scale	105	7.69		
Gray Reading	105	4.73	.58	9.95**
Gray Reading	105	4.73		
WISC Verbal	105	7.41	.59	9.24**
Gray Reading	90	4.48		
WISC Vocabulary	90	7.12	.55	8.25**
Gray Reading	100	4.83		
WISC Coding	100	7.70	.40	7.73**
WISC Full Scale	65	8.12		
Gray Reading	65	5.22	.57	7.84**
WISC Full Scale	65	8.12		
Stanford Reading	65	5.71	.59	7.77**
WISC Full Scale	65	8.12		
Stanford Arithmetic	65	5.11	.64	10.75**
Gray Reading	65	5.22		
Stanford Reading	65	5.71	.77	1.82
Stanford Reading	65	5.71		
Stanford Arithmetic	65	5.11	.71	2.61*
Stanford Arithmetic	64	5.11		
WISC Arithmetic	64	8.19	.46	11.59**

*Significant at the .02 level.
**Significant at the .01 level.

Table 3 presents data pertinent to the significance of differences between various *WISC* means and the several reading and arithmetic means, and also among various measures of achievement. Gray Reading is compared with *WISC* Verbal *IQ*, *WISC* Vocabulary, and *WISC* Coding, because these abilities presumably are especially relevant to reading ability (18). All

WISC means are higher than all achievement means, all these differences being significant at better than the .01 level. Especially noteworthy is the fact that the largest t (11.59) is found for Stanford Arithmetic vs. *WISC* Arithmetic! The difference between Gray Reading (oral) and Stanford Reading (Paragraph Meaning and Word Meaning) is hardly of statistical significance ($P < .10$; $r = .77$). Stanford Reading is slightly higher than Stanford Arithmetic, the difference being significant at the .02 level ($r = .71$).

Accurate analysis of the significance of the differences among the eleven *WISC* subtest means would require computation of all the intercorrelations for the group used in the present study. An approximation, however, based on the intercorrelations reported by Wechsler for 200 cases in the normative group of age 13-6 (30, p. 12), will serve to set up rough estimates of significance. The variables involved (besides the mean differences) are the *SD*s of the distributions of subtest scores, the number of cases, and the correlations between scores. Taking all these into account, it can be said in general that mean differences of 1.00 or more tend to be statistically significant. The difference between Block Design and Coding (1.01) and that between Coding and Comprehension (0.94) are significant at the .02 level. The difference between Comprehension and Arithmetic (1.01) is significant at the .01 level. The four subtest means of 7.70 or less (Information, Arithmetic, Vocabulary, Coding) may be considered significantly low in the group *WISC* profile. The three means of 9.30 or more (Picture Completion, Picture Arrangement, Object Assembly) may be considered significantly high.

D. Discussion

Our results in general agree with those of previous studies, summarized in the introduction to this report. The mean Full Scale *WISC IQ* for our group of delinquents falls in Wechsler's Dull Normal category (30, p. 16). Though Bright Normal, Superior, and Very Superior individuals are not entirely absent, their proportion is much smaller than in a normal sample. The Verbal *IQ* is lower than the Performance *IQ*. Though the mean Performance *IQ* falls within the Average category, it is significantly lower than the normal mean of 100. Our data, to be sure, do not permit comparison between our group and a group of non-delinquents of similar social and economic status. Glueck and Glueck (16), with delinquents and non-delinquents matched for residence in underprivileged neighborhoods and approximately matched for Full Scale Wechsler-Bellevue *IQ*, found the total Performance

Weighted Score equal for the two groups, but the total Verbal Weighted Score significantly less for the delinquent than for the non-delinquent group.

Jastak and Gilliland's conclusion (20) that the average delinquent is of average intelligence but deficient in language is partially but not precisely borne out by our findings. It is true that in certain Performance tests our delinquents are not significantly different from the average, but these are only three subtests out of a battery of 11. It is also true that the tests which most involve linguistic or symbolic abilities are among the lowest (Reading, Arithmetic, Vocabulary, Coding). Our results are better summarized in the statement that the average child referred to the New Jersey Diagnostic Center is somewhat below the norm in general intelligence but close to average in tests that do not require the use of symbols.

The most outstanding feature in our results, however, is the tendency for our group to be lowest in the abilities that are developed *in school*. Reading, measured by the Gray oral reading test and the Stanford Achievement Test, and arithmetic, as measured by the Stanford test, yield by far the lowest scores. The two reading tests and the Stanford Reading and Stanford Arithmetic show higher correlations with each other than they show with *IQ* (Table 3). Though *WISC* Arithmetic stands among the significantly low *WISC* subtest scores (Table 2), Stanford Arithmetic, more specifically related to school standards, falls much lower. Comparison of the *WISC* and Stanford arithmetic test materials throws further light on this matter. Half of the Stanford is pure computation. Half is "Arithmetic Reasoning," apparently comparable to the *WISC* Arithmetic test. However, the Stanford Arithmetic problems must be *read* by the subject instead of being given orally by the Examiner. Also the Stanford problems are more academic in style.

Glueck and Glueck (16) found that for both their delinquents and non-delinquents the lowest mean Wechsler-Bellevue weighted score was that for Arithmetic, but that the difference between the two groups in this respect was not significant. The mean Stanford Arithmetic Quotients for the two groups differed significantly, however, as did the mean Stanford Reading Quotients. Furthermore, the two groups were even further apart in school attainment (scholarship in last full year of school) than might be expected from their Stanford Achievement Test.

Even among the *WISC* subtests, the ones most closely related to school learning are the lowest: Vocabulary, Information, and Arithmetic. Coding, fourth lowest among the subtests, may throw some light on this matter. Glueck and Glueck (16) found that the Digit-Symbol subtest (the Wechsler-Bellevue equivalent of the *WISC* Coding) gave the subtest score which distinguished most significantly between their matched groups of delinquents and non-delinquents. They comment that this test involves concentration and persistency of effort. Certainly it seems less intrinsically interesting than the other Performance subtests. It stands lowest among the Performance tests for the Gluecks' non-delinquents as well as for their delinquents, but much lower for delinquents than for non-delinquents in the matched groups. Coding is the only Performance test that is significantly low in the *WISC* profile of our group.[3]

These results of ours, combined with the findings of Glueck and Glueck, suggest that the delinquent's deficiency in school achievement is related not so much to inability to do school work as to nonconformity to the standards set by the school.

A study analyzing the *WISC* subtest scores of delinquents should probably include a comparison with Wechsler's list of characteristics of adolescents with psychopathic personality (29, p. 149). Our results agree with his in the following points:

1. Performance higher than Verbal.
2. Object Assembly: high.
5. Arithmetic: poor.
7. Picture Arrangement: relatively good.

9. Sum of Block Design and Picture Completion test scores nearly always less than sum of Object Assembly and Picture Arrangement test scores. (We find the sum of the means for the Block Design and Picture Completion tests to be less than the sum of the means for the Object Assembly and Picture Arrangement tests.) Our results disagree where Wechsler finds:

3. Information: high.
6. Similarities: poor.
8. Picture Completion: frequently poor.

Where Wechsler reports Comprehension as "unpredictable," and Interest Variability as "moderate," our data have not been treated so as to bring out a comparison. To find reasons for the three points of disagreement between our findings and Wechsler's would also require further study.

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[3] Harris and Roswell (18) speak of the digit substitution test as revealing a slowness of associative learning that is characteristic of the poor reader. The fact that the Coding subtest does not correlate as highly with reading as does the Full Scale *IQ* may be due partly to the lower reliability of the subtest.

E. SUMMARY

1. Analysis was made of *WISC* and school achievement scores of 105 children referred by the Court to the New Jersey Diagnostic Center. The school achievement tests were Gray's Standardized Oral Reading Paragraphs and the Average Reading and Average Arithmetic from the Stanford Achievement Test, Form *D*. The number of cases for whom Stanford Reading and Arithmetic scores were available was 65. These 65 cases as a group do not differ significantly in *WISC* Full Scale *IQ* and Gray Reading status from the 40 for whom Stanford scores were not available.

2. The 15 girls in the sample do not differ significantly from the 90 boys in *WISC* Full Scale *IQ*. Data from the two sexes have been combined in the results.

3. All scores were transmuted to units comparable to the *WISC* subtest scores, in which the mean for the child's age is set at 10 and the *SD* at 3.

4. The mean *WISC IQ*s for the group were: Full Scale, 88.4; Verbal, 87.0; Performance, 92.4. All these means differ significantly from the norms for Wechsler's standardization group. The mean Performance *IQ* is significantly higher than the mean Verbal *IQ*.

5. Of the mean *WISC* subtest scores, Object Assembly, Picture Arrangement, and Picture Completion do not differ significantly from the norm. The four lowest subtests are Vocabulary, Information, Arithmetic, and Coding, all of which are significantly lower than the three highest. The lowest scores are in tests which are most dependent on school learning or which require concentration and persistency of effort in a task involving symbols.

6. By far the lowest ratings for the group are those in the school achievement tests in Reading and Arithmetic.

7. The above findings agree with those of other investigators in suggesting that the delinquent is not so much deficient in intellectual ability as in the utilization of his ability in school tasks.

8. The results of this study are in agreement with five of Wechsler's signs of adolescent psychopathic personality; in disagreement with three.

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The Journal of Genetic Psychology, 1956, 89, 263-276.

TRENDS IN THE "FEARS AND WORRIES" OF SCHOOL CHILDREN AS RELATED TO SOCIO-ECONOMIC STATUS AND AGE*[1]

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A. THE PROBLEM AREA

Current educational theory and practice require that school learning should comprise more than mere imparting of *knowledge* to the pupils. The simple acquisition of factual materials on the part of pupils is no longer adequate to prepare them for living in our increasingly complex and rapidly changing society. Neither is it sufficient in terms of the wide range of *objectives* that the public school has been committed to fulfilling.

Much has been written in recent years concerning the development of the "whole" child and of the crucial rôle of the school in this undertaking. Several very recent publications by Hymes (6) and Odenwald (11) have added continued support to this view. In Odenwald the following cogent statement may be read: ". . . the school is coming to recognize the rôle it must play in evaluating and developing the whole individual, physically, intellectually, socially, and emotionally . . ." (p. 19). Coupled with this viewpoint we have the continued emphasis by educators and others on mental health in the classroom as evidenced by the current yearbook of the National Society for the Study of Education (5).

Certainly it is almost axiomatic to state that a child cannot be expected to do good school work, particularly in such problem-solving activities as are required in academic skills, if he or she is emotionally disturbed, anxious, or worried. No human organism can perform at maximum efficiency under such a burden. One approach to the solution of this dilemma is centered around investigations dealing with the fears of children of both pre-school and school ages. Examples of studies in this area are those by Angelino and Shedd (1), Davidson (2), Hagman (4), Jersild and Holmes (7), Jersild,

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*Received in the Editorial Office on July 13, 1955.

[1] Portions of this paper were presented at the 1955 meeting of the American Educational Research Association held in St. Louis, Missouri.

[2] The authors wish to express their gratitude to the Faculty Research Committee of the University of Oklahoma for financial assistance which made possible the completion and publication of this study.

Markey, and Jersild (8), Pratt (12), Wake (13), and Wallis (14). Techniques used in these studies were the oral and written questionnaire and written reports in response to certain stimulus questions. The basic notion involved in the research dealing with fears and worries is determining what categories of these fears and worries are most prevalent in children at different ages.

Albeit many more refined investigations must be carried out in this area, the practical import of these studies to the classroom teacher can hardly be gainsaid. More specifically, information relative to these expressed fears of children is valuable for the insight it provides into the nature and level of emotional adjustments.

Keeping in mind the ultimate goal of utility in educational practice, this investigation was concerned with the following questions: (*a*) How do pupils from two *different socio-economic* levels compare with respect to their expressed fears and worries; and (*b*) Do the different categories of fears and worries take on characteristic trends in terms of either "rising" or "falling" at certain age levels?

B. METHOD

1. *Subjects*

Some 1,100 pupils ranging from 9 through 18 years of age were sampled. The numerical division between sexes was approximately 50 per cent boys and 50 per cent girls (boys $N = 562$; girls $N = 568$). *S*s studied in the present report were from schools in the Oklahoma City area.

2. *Classification of "Fears and Worries"*

All *S*s were requested by their regular teacher to— "list the fears and worries you think persons of your own age group have." All reports were to remain anonymous. No attempt was made either to interview each *S* or to structure the list in any way. The expressed "fears and worries" on the respective lists of some 1,100 pupils were classified into 10 broad categories as follows: Safety, School, Natural Phenomena, Animals, Health, Economic and Political, Personal Appearance, Social Relations, Personal Conduct, and Supernatural.

3. *Socio-Economic Status*

An attempt was made to sample two broad classes of pupils in terms of socio-economic backgrounds. All *S*s were classified as being from either a "high" or a "low" socio-economic background. Criteria as presented by Warner and Associates (15) and Davis-Eells (3) were used as guides in this problem.[3] For example, pupils in the "high" *S-E* level were drawn from such schools in the Oklahoma City area as Nichols Hills and Casady. For the "low" *S-E* levels pupils from Crooked Oak were selected.

C. THE EMPIRICAL DATA

Table 1 summarizes the means for the *total*[4] number of fears and worries indicated by all boys and all girls from two differing socio-economic levels for each of ten categories.

TABLE 1
SUMMARY OF MEANS FOR THE TOTAL NUMBER OF FEARS AND WORRIES INDICATED BY BOTH BOYS AND GIRLS FROM TWO DIFFERING SOCIO-ECONOMIC LEVELS IN EACH OF TEN CATEGORIES

	Boys		Girls	
Category	Upper *S-E* ($N = 179$)	Lower *S-E* ($N = 383$)	Upper *S-E* ($N = 178$)	Lower *S-E* ($N = 390$)
I. Safety	1.07	1.05	.87	1.30
II. School	1.32	1.06	1.39	1.14
III. Personal Appearance	.04	.02	.06	.17
IV. Natural Phenomena	.28	.13	.25	.35
V. Economical & Political	.49	.44	.40	.27
VI. Health	.26	.16	.34	.20
VII. Animals	.20	.51	.22	.64
VIII. Social Relations	.43	.37	.63	.58
IX. Personal Conduct	.28	.22	.27	.28
X. Supernatural	.04	.04	.09	.04

An analysis of the expressed fears and worries in the various categories is presented below. Figure 1 graphically displays the mean number of fears and worries related to "Safety" as expressed by boys and girls in our sample. The trend of these curves clearly indicates that concerns over "Safety" decrease in both socio-economic groups as a function of age.

Fears related to "Safety" showed greatest concern at ages 9, 10, and 11 for "lower" boys, and 9, 10, 11, and 12 for "upper" boys; 9, 10, 11, and 16 for "lower" girls, and 9, 10, 11, 12, and 16 for "upper" girls.

Qualitative inspection of the protocols showed that the "lower" boys were more concerned with matters of violence such as robbers, killers, guns, switchblades, dope peddlers, and whippings, as well as being afraid of their parents more than the "upper" boys. Car accidents, storms, and more or less nebulous phenomena such as being hurt, getting killed, juvenile delinquents, school accidents, and disaster worried the "upper" boys and were less mentioned by the "lower" boys.

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[3] Methods for defining the social-class status of individuals have been developed during the last 20 years through intensive studies of selected American communities. The original impetus was provided by the anthropologist, W. Lloyd Warner. (See W. Lloyd Warner and others. *Yankee City Series*, Yale University Press.) Six volumes have been planned, of which four are already published.

[4] In order to compute the total means ($\overline{X}_t$) summarized in Table 1, the number of fears and worries (F & W) in each category was summed (Σ) and divided by the number of pupils (N) in each particular category. Thus: $\overline{X}_t = \frac{\Sigma(F \& W)}{N}$.

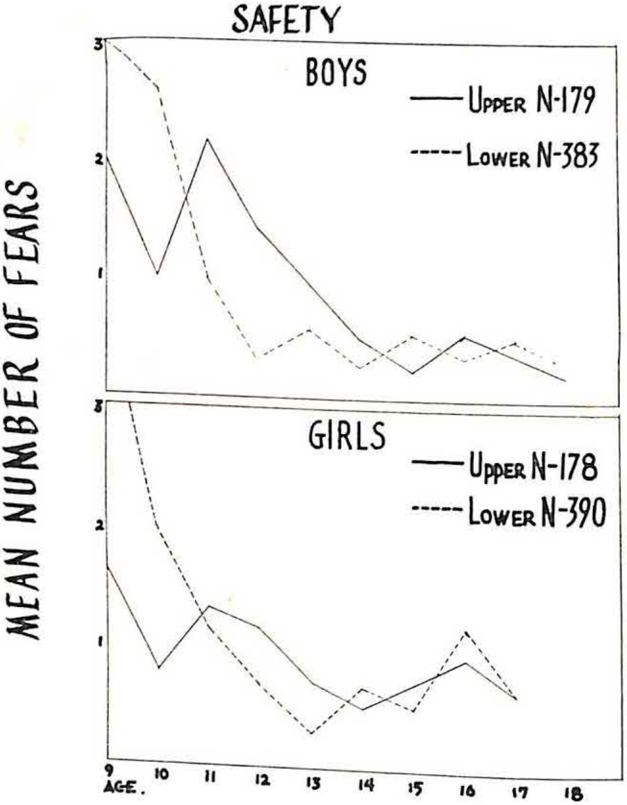

FIGURE 1

Mean number of fears and worries in the "Safety" category as indicated by boys and girls, ages 9 through 18, who were classified as belonging to either a "high" or a "low" socio-economic group.

"Lower" girls were more afraid of animals, strangers, acts of violence, being alone at night, and drunks than were the "upper" girls. On the other hand, the "upper" girls worried more about kidnappers, heights, and a wide variety not mentioned by the "lower" girls such as train and ship wrecks, roller coasters, Communist attack, riots, pet's safety, getting hurt playing hockey, etc.

Fears and worries related to "School" found common to both boys and girls and both socio-economic levels included stagefright, tests, teachers, grades, and school work. However, the "lower" boys were more afraid of the teachers and more susceptible to stagefright than the "upper" boys, while the "upper" boys worried more about grades and school work than did the "lower" boys. A pronounced difference occurred at age 15 where the "lower" boys expressed concern about finishing school and getting to college while the "upper" boys were concerned with getting into the college of their choice.

The "upper" girls had more fears and worries about "School" than did "lower" girls. They also worried more about grades and less about stagefright and tests. In the final analysis there appear to be no real differences between the sexes as they relate to school worries. However, no statistical test for differences was applied.

Figure 2 shows the mean number of fears related to "School" for both

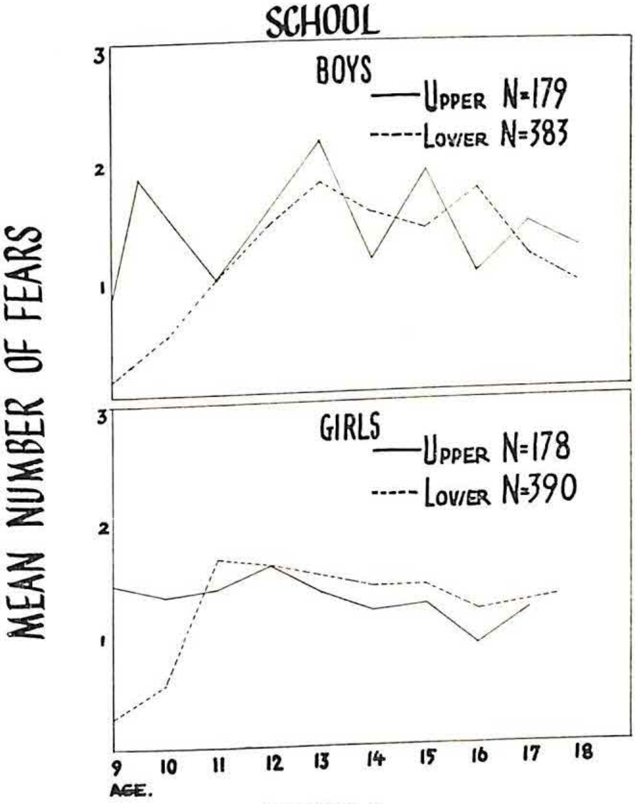

FIGURE 2

Mean number of fears and worries in the "School" category as indicated by boys and girls, ages 9 through 18, who were classified as belonging to either a "high" or a "low" socio-economic group.

sexes, ages 9 through 18. The general trend of the curves here indicates that the shape is somewhat negatively accelerated in both cases. However, the girls appeared to reach the peak of their concern over "School" between ages 11 and 12. The curve for the boys appeared to reach a similar peak at around age 13, clearly somewhat later than exhibited by the girls. Interestingly enough, the curve for the boys shown in part of Figure 2 indicates a slight tendency for the boys from the "high" S-E level to be *more* concerned about "School" at an *earlier* age.

"Fear of Animals" was the most often named of all fears and worries by the lower socio-economic group during the 9th and 10th years but with year 11 this fear tapered off to relative unimportance. Snakes, dogs, and insects respectively were named most often by boys in that order while girls listed dogs, snakes, and insects respectively, and "upper" girls named insects ahead of dogs and snakes. Mice and rats ranked fifth on the "lower" girls' list. The "lower" socio-economic group named some 40 different animals, insects, reptiles, birds, and fish, while the "upper" group listed only 12.

Figure 3 shows the mean number of fears related to "Animals" for both sexes, ages 9 through 18. The general trend here is rather clear-cut. Simply, the curve shows a rapid decrease in the average number of animal fears after age 9 and strikes a negligible low at approximately 12 years. Curiously enough, at ages 9, 10, and 11 the pupils from the "lower" socio-economic bracket exhibited a *higher* number of animal fears.

Figure 4 is concerned with the data for both socio-economic groups in the "Economic and Political" category. The curve appears to be "late rising" or exponential in nature. Concern in this area requires somewhat more sophisticated experience and quite logically does not emerge until the late teens.

In the "Economic and Political" category there are only a few entries made for the "lower" boys (less than 1 in 4) up to age 16. From 16 through 18 a sharp increase was recorded, culminating in an expressed 2.18 worries per person. Comparatively, "upper" boys showed a bit more concern at the earlier ages. However, it was not until age 14 when real interest was expressed which finally reached, at 18, a frequency of 1.25 per individual. "Lower" girls listed few fears (less than 1 in 8) up to age 15 and then showed an increase at age 17. Both sexes and economic groups displayed an increasing interest in this category at older ages.

Differences between the socio-economic levels indicated that the "lower" boys worried more about money than did the "upper" boys. The "upper" boys were concerned about their allowances while the "lower" boys worried about financing college, paying the rent and debts, having to sell the furniture, and getting money to pay traffic tickets. "Lower" boys were worried more about the draft, the police, and jobs, while the "upper" boys were more concerned about war, world conditions, and national affairs. "Upper" girls worried more about world conditions and national affairs and "lower" girls were concerned about money and jobs.

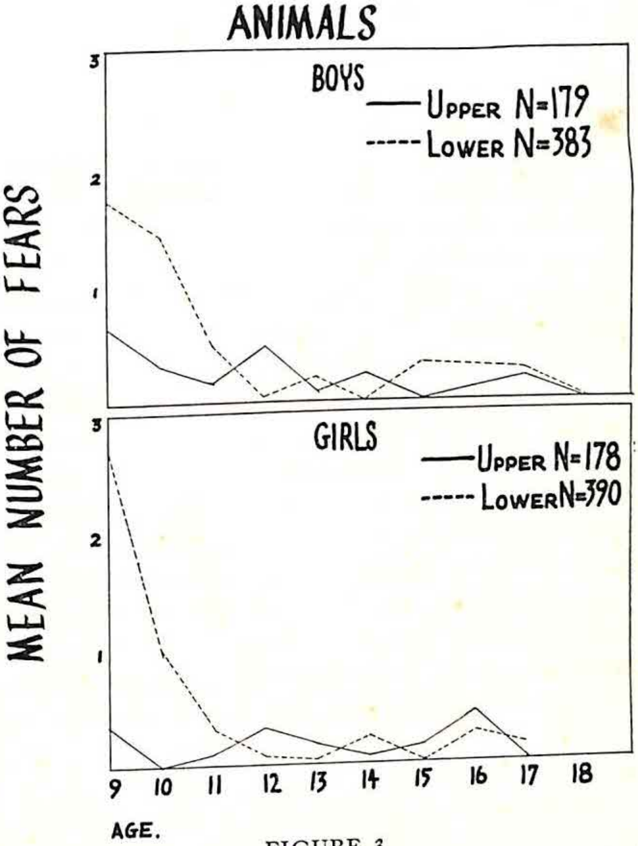

FIGURE 3
Mean number of fears and worries in the "Animals" category as indicated by boys and girls, ages 9 through 18, who were classified as belonging to either a "high" or a "low" socio-economic group.

The fears and worries relating to "Social Relations" included the widest variety of any of the categories, particularly among the girls. The "lower" girls worried most about their reputations, popularity, dates, marriage, and boy friends in that order, while the "upper" girls were more concerned with popularity, dates, boy friends, and reputations respectively. All over-all mean frequency distribution curves tended to rise with approaching maturity. Girls named almost twice as many fears and worries as did the boys though boys too listed a wide variety. "Lower" boys were more concerned with their relation to other boys, to girls, marriage, and getting their feelings hurt in that order, while "upper" boys listed most often popularity, followed by relation to other boys, to girls, and dates. Neither group of boys appeared to be as worried about reputations or problems of dating as were both groups of girls, though, in general, other fears were quite common to all the groups.

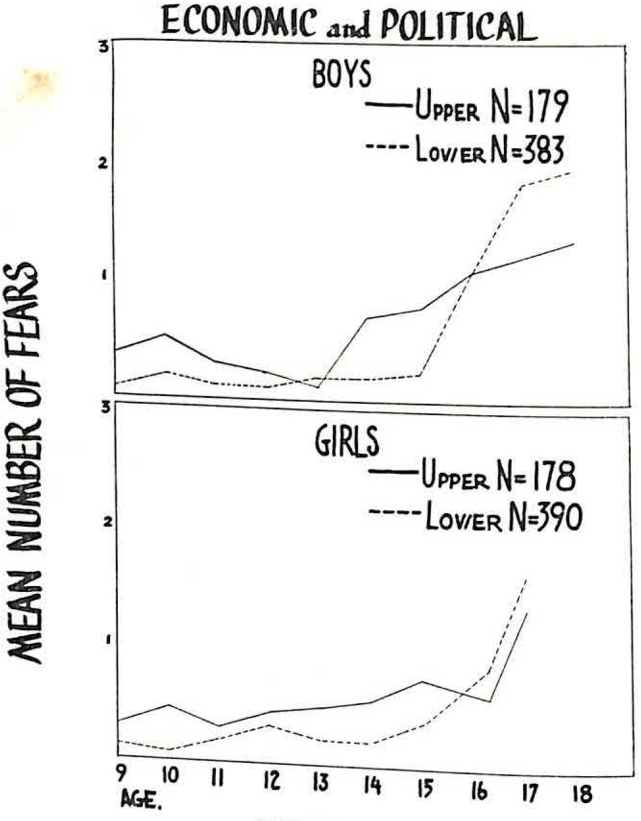

FIGURE 4

Mean number of fears and worries in the "Economic and Political" category as indicated by boys and girls, ages 9 through 18, who were classified as belonging to either a "high" or a "low" socio-economic group.

Figure 5 shows the graphic data for mean number of fears related to "Social Relations." These data are not particularly illuminating except for the fact that a small but steady rise in concern over social relations is exhibited by the girls.

Although graphs were not deemed necessary for description of the remaining fears and worries categories, some brief notes are in order.

The total number of worries related to "Personal Appearance" by boys was a negligible 15, 8 for the "lower" group and 7 for the "upper" group. Both of these were concerned with such things as appearance, being overweight, and clothes.

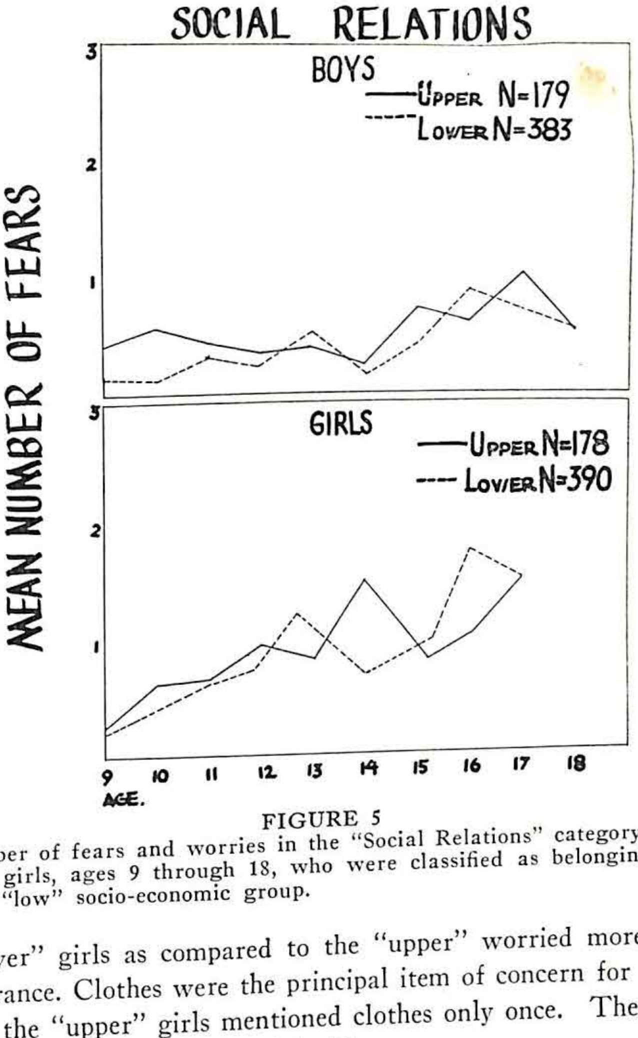

FIGURE 5

Mean number of fears and worries in the "Social Relations" category as indicated by boys and girls, ages 9 through 18, who were classified as belonging to either a "high" or a "low" socio-economic group.

The "lower" girls as compared to the "upper" worried more about personal appearance. Clothes were the principal item of concern for the "lower" girls, while the "upper" girls mentioned clothes only once. There was little difference in the things that worried either group.

In fears and worries pertaining to "Natural Phenomena," the "lower" girls expressed the most, followed in order by the "upper" boys, "lower" boys, and "upper" girls. Differences between the socio-economic groups appeared when the "lower" boys named fire and the dark more often than the "upper" boys, while the "upper" boys cited storms, death, and water more often. "Lower" girls listed storms, the dark, and death more often than "upper" girls, and "upper" girls listed fire and water more often. In general girls expressed more fears of natural phenomena than did boys but with little qualitative difference.

No group appeared overly concerned in the area of "Health." "Upper" girls listed the most worries. "Upper" boys and girls named sickness, polio, dentists, and shots more often while "lower" boys and girls worried more about specific diseases. An occasional mention of dope and dope addicts was made by "lower" boys.

"Personal Conduct" produced a generally consistent number of fears and worries through the ages up to 15. There was exhibited a tendency toward rising concern over personal conduct during the last three years for boys, and at ages 16 and 17 for girls. "Lower" girls tended to manifest greatest concern over personal conduct during ages 15, 16, and 17 to a rather marked degree, being worried more about doing the right thing, parental understanding, and conduct which involved their reputations. "Upper" girls were little concerned about parental approval of their conduct and worried more about dating, and to a lesser degree than "lower" girls, doing the right thing. "Lower" boys worried about getting into trouble and doing the wrong thing, while "upper" boys listed being on time and religion most often.

Little concern was shown by any of the four groups about "Supernatural" things. The "end of the world" appeared most often in all groups with items of superstition making an occasional appearance. No distinction between either sex or socio-economic status was noted. The younger-aged pupil listed most of the entries in this category.

A summation of the total fears listed revealed little difference in the number of fears per pupil between the two groups, the mean number of fears per "lower" boy was 3.48, for the "upper" boy 4.08, for the "lower" girl 4.38, and for the "upper" girl 4.16.

Clearly the differences between the total mean for the two socio-economic groups do not appear to reveal any real statistical divergencies. The main finding here appears to contain the rough generalization that school children, regardless of *S-E* status, have about the same number of problems in each of the 10 fears and worries categories. Stated in another way, *quantitatively* pupils from a low *S-E* class have as many problems (fears and worries) as do pupils from a high *S-E* class.

D. SAMPLING

In every study dealing with the behaviors of a selected portion of the population the question of adequate sampling always arises. How can one determine when he has a sufficiently adequate sample? To be more specific, exactly how many *S*s would one need to produce any real significant differences? Or suppose the question to be answered is concerned with whether nine-year-old pupils from either socio-economic level were significantly different with respect to percentage of fears expressed in a certain category, i.e., "Animals." It is deemed desirable to have an adequate number of cases in order to arrive at a justifiable decision. In addition one needs to know whether the difference obtained is significant at the 1 per cent level of confidence with a "fiducial" range not to exceed 10 per cent.

The computations which follow, using Lacey (9) as a model, will illustrate our point. First we must anticipate from other studies or from exploratory data what percentage of fears in the "Animal" category to *expect*. As a hypothetical example let us use recent data reported by Wallis (14) who found that *S*s between ages 8-14 gave 45 per cent animal response when requested to express their overt fear. Thus we could *expect* animal fears to range in the neighborhood of 40 per cent and can set up our proportion as animal fears = .4n while non-animal fears = .6n. Following Lacey's procedure (p. 214) we may compute X^2 as follows:

$$X^2 = \frac{(.05n)^2}{.4n} + \frac{(.05)^2}{.6n}$$

$$X^2 = \frac{.0025n^2}{.4n} + \frac{.0025n^2}{.6n}$$

$$= .01041n$$

Since X^2 to reach significance at the 1 per cent level of confidence must be 6.635 (1 *df*) we can substitute this value in the equation and discover that 6.635 = .01041n, and in solving for n find that $n = 637.36$. According to this figure some 650 cases should be studied before statistical precision can be reached.

E. DISCUSSION

The present study is one of a number of attempts to study the possibility of a relationship between the socio-economic variable and the number and kinds of fears and worries with which children may be concerned.

Our study included certain aspects not wholly considered by the others. First we are attempting to isolate certain variables which we believe may have some effect on the fears expressed by students. Then we are covering a greater age-span than others, from kindergarten through college. Lastly our methodology differs in that we are using an introspective-projective method to reach aspects of behavior which apparently cannot be reached by other methods.

By asking the pupils to express what *they think* are the things their own age group fear we feel we are getting at areas not possible by the oral interview, checksheet, or questionnaire.

Our continued efforts in this matter are producing results that are in the main similar to those of other studies which have applied other methods, such as those mentioned above.

When one reviews the published literature on fears and worries of different socio-economic levels one can see many similarities to our study.

Jersild, Markey, and Jersild (8) studied approximately 400 children ages 5-12 from two different New York City schools. One group, numbering 240 and attending public school, came from "relatively poor homes"; the other numbering 160, in private school, came from "relatively well-to-do and cultured" homes.

Although the age range of this study only partially correlates with ours, there are, nevertheless, certain pertinent conclusions worth considering.

The poorer children reported more fears of animals, of bad people, and robbers. They reported more fears of supernatural and mysterious events and beings, of scoldings, and failure in school.

The well-to-do children reported more fears of bodily injury and physical danger, of the dark, being alone, and strange sights. They reported more fears of illness, injury, death of relative; also of frightening gestures, noises, tales, and of certain persons or objects. A greater proportion of these well-to-do children reported they had no fears at all.

In a second study Jersild and Holmes (7) report no difference in age group two to six; at six to 12 the higher socio-economic children showed more fears of the possibility of danger (fire, falling, drowning, dying) and of noises. The lower socio-economic children had more fears of a supernatural and remote nature (strange persons, criminal characters, being abandoned by parents, matters connected with death and corpses) and of animals.

Newstatter (10) studied children ages 7 through 14 from 150 families composed of three groups of 50 each from the "poor working class," the "professional and clerical," and the "well-to-do" families in London. Only incidentally was the study concerned with fears as such. Method used was the oral interview mainly with the mother.

However, the conclusions do contain interesting data about the fears and worries of these children. They show that well-to-do children appear to have as many fears and worries as children of the working class, but of a different kind. The working class children worry about their parents quarreling, about food, about exams, about money, as well as showing a greater fear of noise and punishment. The wealthier children seem to have more generalized fears and worries. Fear of the dark is approximately the same for both groups, 49 per cent for the working class as against 52 for the well-to-do.

Davidson (2) studied 102 children (60 boys, 42 girls) aged 9 to 14 with *IQ*'s of 120 to 200 from diverse environmental backgrounds. She was primarily concerned with the relationship of socio-economic status to variations in certain aspects of personality. Included are the reactions to the stimulus question: "Of what are you most afraid?"

Davidson's findings permit the rejection of her hypothesis that fears are independent of income. They do show, however, that with .95 confidence or better, that fears, or lack of them, are associated with differences in income level.

Although she did find a significant relationship between mere possession of fears and income level, the difference in per cent between income levels for the specific fears are not significant, i.e., the kind of fear as reported is independent of income.

The one notable point in her study was the large number of children in both groups who reported having no fears, 65.6 per cent of the poorest children and 48 per cent of the wealthiest.

In general Davidson avers that though fears and worries seem to appear in all groups of children the type of thing feared as well as the kind of worry is often different in the poor and the well-to-do groups.

The above studies agree in the main with our own data, even though they are too limited in range and number to permit making generalizations regarding the relationship between socio-economic status and fears and worries.

However, the evidence from the published studies appears to justify our conclusions, namely that the socio-economic background does condition certain aspects of the personality which include the quantity and quality of reported fears and worries.

F. SUMMARY

Some 1,100 school children aged 9 through 18 were sampled as to their self-expressed fears and worries. Two different socio-economic groups were used, one from a high and the other from a low socio-economic level.

Under investigation were: (*a*) a comparison of the two socio-economic groups as to their expressed fears and worries; (*b*) certain presumed characteristic trends in terms of either "rising" or "falling" at age levels.

The expressed fears were analyzed and placed into 10 categories. Both socio-economic groups were compared by sex in each category. Certain differences were noted between sexes as well as between groups.

Our data showed a positive relationship between socio-economic background and the number and kinds of reported fears. Socio-economic background may be considered as an important variable in the self-expressed fears of different social groups, especially so when the qualitative nature of these fears is examined.

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SHORT ARTICLES AND NOTES

The Journal of Genetic Psychology, 1956, **89**, 277-278.

EMPATHIC AND SOCIOMETRIC STATUS AMONG YOUNG TEEN-AGERS*

Neal Junior High School and Illinois Institute of Technology

GRACE ROSE, NORMAN FRANKEL, AND WILLARD KERR

A. INTRODUCTION

Previous studies of the relationship between empathy and sociometric choice have reported significant positive relationships. One study (1) on college men reported an r of .34. Another study (2) on skilled building tradesmen yielded an r of .59. Since all of these results have been positive but only on adult samples, it seems reasonable to hypothesize that the same type of relationship should exist in adolescent age groups.

B. PURPOSE

The intent of this study is to determine the relationship of empathic ability as measured by *The Empathy Test* (1) to the tendency to be chosen in friendship nominations among young teen-agers and also to compare teen-age with adult empathy.

C. PROCEDURE

Subject of this study were 112 junior high school students (North Chicago, Illinois), 60 female and 52 male. Both the *Empathy Test* data and sociometric data were collected on different days under group administration. The 112 students constituted two classes, and each class was administered the sociometric nominations form which listed alphabetically all the names of the students in that class. This list was headed "Check the names of five people you like best and underline the names of five people you like least."

D. RESULTS

Empathy Test median scores were under those of adult norms. The median of 58 on Form B for boys and of 54 for girls compares, for example, with the median of 69 for 117 college men and the median of 57 for 154 college women.

It seems significant in interpreting these results that the improvement in empathy with age is notably greater (11 points) among men than among

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*Received in the Editorial Office on April 6, 1955.

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Neal Junior High School and Illinois Institute of Technology

Grace Rose, Norman Frankel, and Willard Kerr

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women (3 points). This result was anticipated on the grounds that *men lead a less sheltered life* which permits them to acquire more empathic insight into more diverse personalities and human groups. These data suggest a tentative hypothesis that the empathic ability curve of females decelerates and begins to "flatten out" about the age of 13. Other norm data on *The Empathy Test* indicate that the "flattening out" of male empathic growth does not typically occur until about five years later.

A sociometric popularity score was computed (number of favorable nominations squared minus the number of unfavorable nominations squared) on each individual and these scores were then correlated with scores on *The Empathy Test.* This Pearsonian product-moment correlation was .05 for females and .06 for males, both insignificant. Failure to find a relation between empathic status and sociometric popularity at this young age level suggests that there is perhaps a "lag" in the effect which empathic maturation exercises upon sociometric status. This "lag hypothesis" deserves further testing.

E. Summary and Conclusions

A total of 112 seventh and eighth grade students were administered *The Empathy Test* and a sociometric popularity survey for the purposes of studying the relation between the two measures and for learning more about the chronological course of empathic development. Available data on adult norms facilitated the latter purpose. In these data—

1. Contradictory to the situation among adults, the relation between empathy scores and sociometric status for these young teen-agers was near zero.

2. As among adults, teen-age males scored higher than teen-age females in average tendencies.

3. The gap in the empathic superiority of males over females was very narrow among teen-agers as compared with the similar gap among college students. The differential gap plus the empathic-sociometric non-relationship suggests that a hypothesis of "lag" in the effect which empathic maturation has upon sociometric status deserves further testing.

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The Journal of Genetic Psychology, 1956, 89, 279-284.

BOOKS

The *Journal of Genetic Psychology*, the *Journal of General Psychology*, and the *Journal of Social Psychology*, will buy competent reviews at not less than $2 per printed page and not more than $3 per printed page, but not more than $15.00 for a single review.

Conditions. Only those books that are listed below in this section are eligible for such reviews. In general, any book so listed contains one or more of the following traits: (*a*) Makes an important theoretical contribution; (*b*) consists largely of original experimental research; (*c*) has a creative or revolutionary influence in some special field or the entire field of psychology; (*d*) presents important techniques.

The books are listed approximately in order of receipt, and cover a period of not more than three years. A reviewer must possess the Ph.D. degree or its equal in training and experience.

Procedure. If among the books listed below there is one that seems important to you, you are invited to write a review of that book. It is not necessary to make arrangements with the Editor. Just send in your review. It does not matter if the book in question has been reviewed before.

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CRITICAL REVIEWS OF RECENT BOOKS

The Journal of Genetic Psychology, 1956, **89**, 281-282.

(Werner, Heinz, Ed. On Expressive Language. Worcester, Mass.: Clark Univ. Press, 1955. Pp. 81.)

REVIEWED BY MICHAEL WERTHEIMER

This small volume presents in an hour's reading a succinct, persuasive, convincing statement of what one might call the cognitive approach to language. It summarizes some ingenious studies and their theoretical backgrounds, pulling the difficult, almost evanescent area of the subjective connotations and feeling tones of words squarely into the center of experimental psychology. All of the papers, but especially those by Werner, Kaplan, and Asch on the Clark and Swarthmore studies, provide an impressive answer to the all-too-frequent behaviorist indictment of non-operationists as negativistic; the reader learns clearly, in positive forward steps, what is meant by going behind behavior, by acting on the belief, which Adams attributes to Werner and Asch in contrast to Skinner, that "experience forms part of the subject matter of psychology."

The monograph, one of the Clark University Monographs in Psychology and Related Disciplines, is a compilation of the papers presented at a symposium on expressive aspects of language activity sponsored by the Rockefeller Foundation. Although several disciplines are represented by the participants who gave papers (philosophy, linguistics, and psychiatry as well as psychology), the volume forms a surprisingly coherent unit; this is due to the numerous cross-references and to the fact that many of the writers are thoroughly familiar with the work of other members of the panel. This unity is marred by only one characteristic: the inevitable variations in level of discussion, as for example in the unusually high level and the relatively specialized tone of Jakobson's scholarly and informative paper.

It is perhaps unfortunate that the monograph could not include a brief summary of the discussion following each paper; but in a group which is as relatively homogeneous as this in theoretical inclination, probably Werner's decision to exclude it is not so serious. For that matter, the booklet is now of a convenient length. Comparing it with other technical papers, this reviewer found it surprisingly and gratifyingly well-written; though scholarly, it is highly readable and entertaining. Aside from recommending it on grounds of pure enjoyment, this reviewer feels that no philosopher or psychologist interested in language can afford not to read it.

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BOOKS RECENTLY RECEIVED

(There will always be two pages of book titles, listed in the order of receipt, i.e., the most recently received books will be found at the end of the list.)

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